

AD-A246 741



0  
DTIC  
SELECTED  
MARCH 3, 1992  
S B D

AN EXPERT SYSTEM JOB AID  
FOR USERS OF THE  
AUTOMATED SCHEDULING MODULE

THESIS

Kevin A. Gore, Captain, USAF

APTT/ATM/REV/01C-22

DISTRIBUTION STATEMENT A  
Approved for public release  
Distribution Unlocked

DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

92-04853



Wright-Patterson Air Force Base, Ohio

92 2 25 126

**AFIT/GLM/DEV/91S-22**

**AN EXPERT SYSTEM JOB AID  
FOR USERS OF THE  
AUTOMATED SCHEDULING MODULE**

**THESIS**

**Kevin A. Gore, Captain, USAF**

**AFIT/GLM/DEV/91S-22**

**Approved for public release; distribution unlimited**

The views expressed in this thesis are those of the authors  
and do not reflect the official policy or position of the  
Department of Defense or the U.S. Government.



Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
R-1	

AFIT/GLM/DEV/91S-22

AN EXPERT SYSTEM JOB AID FOR USERS OF THE AUTOMATED  
SCHEDULING MODULE

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Logistics Management

Kevin A. Gore, B.S.

Captain, USAF

September 1991

Approved for public release; distribution unlimited

## Preface

The purpose of my research was to design an expert system job aid for users of the Automated Scheduling Module (ASM), primarily aimed at the Tactical Air Command (TAC) 392XX personnel, because a great many of them have not seen or used the software which will automate their scheduling processes.

A prototype job aid using KnowledgePro software was completed and verified by several 392XX personnel who perceived there to be value-added in this sort of endeavor. The expert system should continue to be verified with an eye on adding more "expertise" to the knowledge base, in hopes to fully validate the product in the near future.

A number of individuals gave me guidance and support. These included: my thesis advisor, Lt Col James Holt; my thesis sponsor, the Air Force Logistics Management Center, especially Capt Dave Martin and Lt Col (Ret) Tim Peterson who provided much needed direction, and Flt Lt Paul Pappas, (RAAF) whose venture into KnowledgePro proved to be the source of inspiration I needed. A very special thanks goes to my expert MSgt J.J. Thomas, who was continually helpful.

This thesis is dedicated to my wife, Marian Hudson-Gore, who was patient and understanding, especially during those last 'crunch' days, and my daughter, Kellie, who continually walked on my thesis drafts, reminding me of what things are really important in this life.

## Table of Contents

	Page
Preface . . . . .	ii
List of Figures . . . . .	v
Abstract . . . . .	vi
I. Research Problem . . . . .	1
Overview . . . . .	1
Specific Problem . . . . .	2
Possible solution . . . . .	3
Selection of an Expert System . . . . .	4
Justification of Research . . . . .	4
Scope . . . . .	5
Summary . . . . .	5
II. Literature Review . . . . .	7
Overview . . . . .	7
Early Automated Maintenance Scheduling . . . . .	7
The ASM Problem . . . . .	11
Possible Better Solution . . . . .	12
Definition of an Expert System . . . . .	12
Another Kind of Expert System . . . . .	14
Current Trends in Training Theory . . . . .	17
Limits on Expert Systems . . . . .	18
User-System Interface . . . . .	18
Expert Systems as Job Aids . . . . .	20
Summary . . . . .	20
III. Preparing for the Expert System . . . . .	22
Overview . . . . .	22
Researcher Education . . . . .	22
Critical Questions . . . . .	22
Designing the Expert System . . . . .	24
Expert System Requirements Determination . . . . .	25
Verification/Validation of the Expert Systems . . . . .	26
IV. Developing the Expert System . . . . .	28
Overview . . . . .	28
System One . . . . .	28
Interview Session . . . . .	29
System Two . . . . .	29
Validation Session . . . . .	31
Overall Success . . . . .	32

	Page
V. Conclusions . . . . .	33
Overview . . . . .	33
Recommendations . . . . .	33
Insight . . . . .	35
Appendix A: Inspection System Definitions . . . . .	38
Appendix B: Cover Letter. . . . .	40
Appendix C: System One Source Code. . . . .	42
Appendix D: Sample 97th SBW Weekly Plan . . . . .	55
Appendix E: Recommendations from Prototype Session . .	58
Appendix F: Interview Session . . . . .	59
Appendix G: System Two Source Code . . . . .	61
Bibliography . . . . .	115
Vita . . . . .	118

### List of Figures

Figure	Page
1. An Expert System . . . . .	19

Abstract

This research developed an Expert System for novice aircraft maintenance schedulers (AFSC: 392XX) with little experience using the Automated Scheduling Module (ASM). First, an in-depth literature review was completed. Next, personal interviews were conducted with an ASM expert and other 392XX personnel. Prototypes using VP-Expert and KnowledgePro shells were created. The KnowledgePro shell was selected to create the ASM Job Aid, combining the knowledge of the expert and AFM 66-279. The program was verified, validated, and favorably reviewed by 392XX personnel.

Recommendations include: The Air Force Logistics Management Center (AFLMC) examine the ASM Job Aid and develop a Performance Support System for 392XX personnel. Students attending course MM325-168 should receive a copy of the job aid prior to course start date. Units implementing ASM should receive copies of the ASM Job Aid in order to add expertise to the program. Finally, TAC should review lessons learned from other units using ASM.

ASM enables schedulers to better forecast when major maintenance expenses occur. As Defense Management Report Decision (DMRD) 904 becomes a reality in 1992, units with

ASM trained schedulers will be better prepared to help  
manage AF Stock Funds and foster significant savings at base  
level.

AN EXPERT SYSTEM JOB AID FOR USERS OF THE AUTOMATED  
SCHEDULING MODULE (ASM)

I. Research Problem

Overview

The purpose of the Aircraft Maintenance Plans and Scheduling Section at base level is:

...to act as the focal point for planning and controlling the utilization and maintenance of aircraft and maintenance support resources. This function is critical to the overall mission success of the unit. The scheduler must optimally balance airframe ground time versus flying time to insure that both operations and maintenance requirements are met. A number of forces constantly compete for airframe ground and flying time. These [ten] competing forces are categorized as follows: Operational Missions, Functional Check Flight, Alert/Static Display, Scheduled Maintenance, Unscheduled Maintenance, Servicing, Ground Handling, Reconfiguration and Loading, Awaiting Parts and Ground Training. (37:2)

The specific activities within those ten categories listed above literally explode into thousands of activities per unit each month. Each activity has associated operating constraints or rules to further challenge the maintenance scheduler (37:2). A seemingly endless and exhaustive number of activity combinations are possible over a period of time, and it is the scheduler who sets activity priorities to develop the Aircraft Utilization and Maintenance Schedule (37:2).

Aircraft maintenance schedulers received the newest version of the Automated Scheduling Module (ASM) in December 1990. ASM is designed to combat the complexities of scheduling aircraft utilization and maintenance. It has vast improvements over manual and previous tried automated programs, incorporating pull-down menus, and help screens. However, it does not provide the total training mechanism necessary for quick and easy training of the prime users (24).

#### Specific Problem

Senior aircraft maintenance schedulers testing ASM caution improvements are already needed to warrant efficient use of the software (34). The Air Force Logistics Management Center (AFLMC) completed some initial testing of the ASM program in-house, and determined it was an ideal candidate for a performance support system, which includes developing an expert system training module (Appendix B).

The Core Automated Maintenance System (CAMS), of which ASM is a subsystem, has been a hierarchical "nightmare" for aircraft maintenance technicians. The human factors engineering incorporated into CAMS is minimal. Poor menuing and screen design has continued to reduce effectiveness of the system. First, it has too many separate menus, and secondly, it has no sequential screen numbering (i.e. a technician may page from Screen #49 to #349). In many cases, technicians page through as many as eight pages

before reaching the data entry point. This phenomenon has caused many technicians to carry around cheat sheets in order to know which screens they need to use (24).

ASM has a lot of screens and separate menus also, therefore, schedulers still have similar user-interface problems as with other CAMS subsystems. System Designers, until recently, have not realized training (on any system) is actually part of the system. Therefore, training efforts have always been misplaced (4:14).

...training has been designed to help minimize the disruption caused by the implementation of a given system. Today, the system itself will have to take on much of the training responsibility - including minimizing disruption. This will require training designers, metamorphosed into full-scale performance technologists, to become part of the system design team itself, since their expertise will be crucial to effective system design. (4:14)

#### Possible solution

One solution to this management problem of better quality ASM training, is the use of an automated knowledge consultation, or expert system job aid. An expert system job aid, defined in chapter two, would be easy to use, and less costly to implement than a formal training program. It could even supplement a viable On-the-Job-Training (OJT) program at the unit level or act as an adjunct to existing training courses, such as the MM325-168 Plans, Scheduling and Documentation course taught by the 325th Automation Training Branch at Tyndall AFB FL.

### Selection of an Expert System

The capability of expert systems to use heuristics, accommodate uncertainty, and explain their reasoning, and the availability of easy-to-use shells suggests that this new technology may be quite useful in many fields (14:6). Computer technologies such as Artificial Intelligence (AI), and particularly Expert Systems (ES) offer special capabilities to insert training into computer programs. They are possible answers to bridge the gap from manual to automated scheduling. They are not panaceas, but are fast becoming technologies to foster increased productivity and assembling of expert knowledge (6:22; 17:137). The creation of an expert system will potentially eliminate some of the problems users of CAMS subsystems currently experience.

ASM has a lot of screens and separate menus (lots of information). Therefore, schedulers will be able to use ASM much quicker if an expert system could pass on heuristic experiences and knowledge captured through a knowledge engineering process.

### Justification of Research

Aircraft Maintenance Schedulers are not using ASM to its potential because the system is more difficult to operate than advertised (24). An ASM expert system job aid would provide schedulers quicker and more efficient training, rapid access to automated manuals, use of logical

heuristics, and expert advice to enable better use of the ASM software.

This thesis demonstrates how a current, 'off-the-shelf' expert system shell can be used to create a useful job aid for the Maintenance Scheduler who is not fully using ASM.

### Scope

This research paper focuses on selecting an off-the-shelf expert system shell to build an ASM Expert System Job Aid for the 5 to 7 level Aircraft Maintenance Scheduler. These personnel produce the primary outputs of ASM, the Weekly and Monthly Aircraft Utilization schedules (37).

Tactical Air Command (TAC) was chosen as the 'model' command. Scheduling of tactical forces is very demanding, because the maintenance database for TAC aircraft is larger than other commands, and there are significant configuration changes associated with tactical aircraft (34).

Scheduling is more challenging due to these factors. TAC has, therefore, chosen a more formalized approach to ease implementation of ASM (34).

### Summary

This chapter presents the overall purpose of the research effort. Chapter two discusses literature on the history of ASM development as well as information on rule-based expert systems, and other technologies in the Artificial Intelligence arena. Chapter three discusses preparation of expert system development. Chapter four

details actual development of the expert system job aid, emphasizing selection of the ES shell, verification and validation of the Expert System Job Aid. Chapter five details conclusions and recommendations of the research effort offering insights this researcher gleaned, and further research suggestions and tactics.

## II. Literature Review

### Overview

The first part of this chapter reviews literature written about ASM. The second part introduces the reader into the technology called, expert systems, discusses current trends in training theory, details limits of expert systems, the importance of a good user-system interface and introduces the concept of an expert system as a job aid.

### Early Automated Maintenance Scheduling

The effective scheduling of aircraft on-equipment maintenance and utilization is crucial to a flying unit's ability to perform its mission. In 1976, the Air Force Logistics Management Center (AFLMC) embarked on a comprehensive program to investigate ways to enhance maintenance scheduling at the unit level through automation.

For almost thirty years, civilian training designers have tried to develop effective training for automated systems; therefore, the primary aim of the program was to locate and evaluate existing computer models for potential application in unit-level aircraft maintenance and utilization scheduling (4:14;37:i). The initial results of the program indicated that some off-the-shelf programs could enhance unit scheduling to some extent. However, serious problems were common to these programs: (1) The models were oriented toward theoretical applications rather than

practical uses, (2) they were "unfriendly" to users, and (3) they were sized beyond the capabilities of base-level computer resources (37:i).

As a result of AFLMC's work, an automated product did surface: the Rand Corporation's Decision Oriented Scheduling System (DOSS), was chosen. But, it also was evaluated as being incompatible for use with base-level computers and required extensive user and programmer training (37:ii).

In October 1981, the research effort was realigned to support the in-house development of a model specifically designed for unit-level aircraft maintenance schedulers. Experienced unit-level schedulers served as the primary information resources for program development. The Automated Flying And Maintenance Scheduling (AFAMS) model was the result of this project (37:iii).

AFAMS generated monthly and weekly flying schedules for aircraft under the phased inspection concept (Appendix A) with a primary goal of insuring a smooth flow of aircraft through the inspection docks. AFAMS came on-line and was developed as the prototype for the Core Automated Maintenance System (CAMS) Increment V. Initially, AFAMS could not be used effectively without some 'work-arounds'. It could be used in a 'smart terminal' mode, via the AFLMC's IBM 4331 computer via remote terminal through telecommunications. The AFAMS software could also be transported to Major Command (MAJCOM) selected microcomputers in a 'stand alone' mode. These methods had

drawbacks, but offered potential for an initial automated scheduling system (37:iii).

Users gave this early AFAMS a favorable evaluation, and suggested improvements. After improvements were programmed, field-level schedulers used the model at their home stations via remote terminal to generate an actual weekly schedule for their particular unit. In the initial field evaluation, a weekly schedule took ten hours of manual generation, but only thirty minutes using AFAMS. The AFAMS schedule was adopted (with minor modifications) and flown as published. As a result, the unit achieved great success - (scheduling and maintenance effectiveness rates of 94 and 100 percent respectively) (37:iii).

Although AFAMS, at that time, was ready for formal field testing, it could not be run on current base-level computers. The program was developed on the AFLMC's IBM 4331 computer as a prototype for the CAMS Increment V, which was not programmed for implementation until mid-1987.

At this point, the Air Force Data Systems Design Center took the initial steps toward transporting the software for CAMS. Phase I of this program was the direct transition of the AFAMS program to what is now called ASM. Phase II provided requirements that were not dependent on CAMS increments. Phase III provided those requirements that were dependent on CAMS (future CAMS increments) (9:2-1).

The specific objectives of ASM are to provide:

- 1) a flexible automated scheduling process using aircraft data downloaded from the CAMS database to a microcomputer.
- 2) a consolidation and reduction of the background processed documents required by schedulers to formulate weekly and monthly maintenance plans.
- 3) the capability to generate aircraft Time Distribution Inspections (TDIs) on the microcomputer.
- 4) the capability to monitor/review aircraft time change data, Time Compliance Technical Orders (TCTOs), and aircraft configuration requirements independent of the Unisys 1100/60 by utilizing the microcomputer (10:4-1).

ASM is intended to be a 'user friendly' menu driven microcomputer system that interfaces with the Unisys 1100/60 base level computer system. Aircraft data necessary for utilization and maintenance planning is downloaded using a screen driven process in an on-line mode (10:2-1 to 2-2). Downloaded data are used to initialize the microcomputer system. ASM enables schedulers to produce more effective schedules, reducing manpower requirements and increasing aircraft capability by eliminating peaks and valleys in inspection requirements. Aircraft maintenance managers can evaluate and make changes to schedules more effectively (10:1-1).

Since the scheduling time-process is significantly reduced, the capability exists to delay the actual schedule

production until later in the week or month to incorporate the most current aircraft database available. Peculiar circumstances, such as last minute depot requirements, urgent action TCTOs, etc. can be incorporated into the scheduling process with minimal effort (10:1-1).

Capt Turner and Lt Verble state it best in Maintenance Scheduling Research:

Prior to an Automated Flying and Maintenance Schedule system, the primary problem schedulers faced in making schedule revisions is that moving one event on the schedule often creates the need to move other events to compensate for resource limitations. In the course of one schedule revision iteration, schedulers can overlook some events which should be moved. And if the revision is a major one, the scheduler may erase large portions of the scheduling board and "drop" some events altogether. Many times these "dropped" or overlooked revisions are not noticed until the event becomes overdue or a resource is overtaxed. (37:3)

#### The ASM Problem

ASM offers all these great possibilities for the maintenance scheduler and yet it is still not being used by all schedulers in all commands (24;34). This program offers too much 'potential' to ignore.

It is usable, but in keeping with CAMS, the user interface leaves much to be desired. It does have data field helps on-line, but once you start using the program, the data field help information is of limited use (Appendix B).

TAC has chosen not to fully implement ASM, because of their complex scheduling tasks and the serious user-interface problems with ASM. TAC has a formal training

program to help users become familiar with ASM, but this program only provides part of the solution toward fully implementing ASM (34).

#### Possible Better Solution

ASM needs some tool to help prime users progress to an intermediate knowledge level. This tool needs to have certain inherent characteristics, such as user-friendliness, and to be integrated with ASM (24). This tool could be an expert system.

During the past several years, expert systems technology has experienced a rapid growth in the fields of medicine, industry, and business (16:22). Expert systems have also been developed for applications such as oil exploration, chemical structure analysis, space vehicle electric power management, and even for suspect identification in armed robbery incidents (1:210).

#### Definition of an Expert System

According to a leading expert in the field:

An expert system is a product of the research work being undertaken in the field of artificial intelligence. The software, usually called a "shell" often in a very user-friendly manner, provides the basis for capturing and storing the knowledge base of the expert. The knowledge is then structured in a manner which reflects the decision-making process of the expert, then to be integrated by the end user. (28:21)

Peterson, defines an expert system as "a computer program which incorporates the knowledge of an expert or group of experts on a particular subject and manipulates the input

data in a fashion that mimics the human reasoning process" (30:20). Pei and Reneau suggest that "rule-based expert systems" (RBESs) are computer programs that apply domain-specific knowledge to problem solving (29:263). Unlike other decision aids, an RBES is intended to assist or possibly replace users in solving problems of narrow scope that require rich expert knowledge (29:263). To round it out, Gingerich and Hochron state "expert systems are computer programs that provide consultation on real problems; an expert system performs much like a human consultant" (16:221; 18:15).

An expert system is almost exactly what it sounds like: a computer program which performs the same role as a human expert. It has detailed knowledge of some specific area (called a 'domain'). It asks the user questions and then provides an answer. It might advise a user on where to look for minerals, identify why a car won't start, or diagnose an infection (7:18). It requests the facts it needs to make a decision (i.e. When did you reenlist? What is your rank? Where are you stationed?). When it finds a rule that matches the facts, that rule 'fires' and provides the answer for the user. If one of the facts does not match the rule, it will look for another rule to fire (7:18). The classic 'rule-based expert system' (RBES), focuses on problem-solving using if-then-else production rules. Typically, a RBES is used to solve problems that can be diagrammed in the form of a decision tree. This type of expert system can be

beneficial, except it does not give the user any control over the system (35:I-3).

Expert systems are a form of 'knowledge-based' systems. They are built from facts, concepts, procedures, rules of thumb, informed guesses and so on - the stuff a human expert uses to arrive at a conclusion. Where traditional Automatic Data Processing (ADP) systems store data, knowledge-based systems store facts (another name for data) and the knowledge of how to use these facts to make decisions (7:18).

#### Another Kind of Expert System

A 'hypertext' expert system focuses not explicitly on problem-solving (rules), but on communication. For the RBES, the same answers will always send the user down the same road. The paths to the solution of a problem is decided by the answers asked by the system. Hypertext is not, strictly speaking, a knowledge representation scheme. Rather, it is a method by which knowledge that has been represented (in other ways) can be logically connected to other knowledge in the knowledge base or outside of it. Hypertext derives from two root words, 'hyper' meaning beyond and 'text' (33:17).

Hypertext allows the user to connect text in ways that go beyond the normal, linear handling of textual material. In an expert system sense, hypertext can be used to represent or deal with knowledge that is layered. Much

knowledge has this characteristic. 'Layered', means the knowledge has several levels. For example, let's say you are using a computerized expert system to help diagnose a problem with your computer so you can fix it yourself. You answer a bunch of questions about how the computer is behaving and the expert system thinks for a moment before displaying its conclusion: 'The video driver needs replacing'. An experienced computer technician would know what a video driver was. However, if you don't know what a video driver is, where it is located, what tool you need to remove it, or how to replace it, you are in trouble. The expert system hasn't been very helpful. Enter hypertext. In a hypertext expert system, if you want more information about a hypertexted word, like video driver, you just select the word or diagram with a mouse pointer, or some other method indicate your interest. The system then links you to some text, or graphics that explains what a video driver is and where it's located. If it is next to the ROM bank, and you don't know where that is, just tell the system you need more information on ROM banks, and off it goes (33:18).

In a hypertext system the user can start with a topic, locate one or more instances of it, and then, without having to return to a master menu, branch to other associated topics. This illustration from CBT Directions, aptly describes the process:

A training specialist might start by looking up text on instructional systems design methodology, jump from one of those references directly to material on job aids,

go from there to interactive video information, and then end by checking out a list of expert system shells. (11:30)

Hypertext allows users to follow their mental processes directly through the text, or media. In a conventional information retrieval system, users could still find the information or topics described above. But, they would have to find one, return to the main menu, find the second, return to the main menu, and so on. The hypertext information accessing process acts much closer to the needs of human minds. The hypertext model is designed to facilitate the work of a human user, not replace it (3:66). Designers have to modify rule-based expert systems significantly in order to increase user skills. Therefore, hypertext systems seem to be much better suited to the training role than traditional expert systems (3:66).

A second advantage of hypertext systems, according to Evans, is in user-interface. Rule-based shells are much more complex to learn and use, and have a limited ability to customize the user interface (12:318). 'Hypertext' technology allows the user freedom to choose what information he desires. It does not need the format and inference tools needed to create more complex expert systems (12:318).

Cognitive scientists reveal that eventually nearly all information based systems will have to allow for unstructured queries which mimic the nonlinear process of

human thought. The current form of these databases is the hypertext model (3:66).

#### Current Trends in Training Theory

Current research indicates that experts and novices differ in the way they think. Each sets up procedures or structures in the mind. The structures are called 'schema' (23:13-14). Schema refers to how the brain programmatically controls access to information. This poses problems initially because the problem-solving strategies of experts and nonexperts are fundamentally different (29:270). Literature suggests that experts structure knowledge in long-term memory in larger chunks which are readily accessed from short-term memory. Experts often recognize immediately what novices require great effort to discover (23:14).

In the training mode, an expert system would then help the novice create the mental structures of the expert (29:266).

Pei and Reneau state:

...it is hypothesized that if an RBES is to be successful as a training device, the knowledge structure of the rule base must be consistent with the user's mental representation of knowledge in the task domain. (29:264)

Therefore, it is imperative that the knowledge engineer complete his job as thoroughly as possible and be functionally literate in the subject matter of choice in order to capture a useful portion of the experts knowledge (29:264).

### Limits on Expert Systems

It's important to understand that while expert systems are powerful, they are 'expert' only within a very limited area. An expert system for picking stocks, isn't able to advise on what bonds to buy, much less whether to invest in gold (7:18). The most important and most difficult area in the development of an expert system is focusing on the area of 'expertise' and extracting the knowledge. Special knowledge engineers are 'computer professionals' who are trained to collect knowledge from the domain expert, and translate it into a computer language. Although specialists, these 'brain-pickers' capture only fractions of the broad expertise in a given field. The human factors involved in 'mining' the expertise are often very difficult to master (29:265).

### User-System Interface

Besides knowledge extraction, User-System Interface (USI) is the next most critical area in expert system design. A consistent, easy-to-use systems interface and straightforward access to a computer program gives a major source of power to the user (Figure 1). If a system user must learn and recall new, diverse, inconsistent, or complex commands to access parts of the system (like with CAMS), its impact is diminished. It simply will not be used to its full potential unless there is no alternative (15:14).

Many RBES shells are considered 'user-friendly' still, it is preferable the user have some programming skills, as well as experience in the expert domain (28:22). To the computer novice, the entire computing task can be difficult. Particularly if there is a poor interaction between the system and the user.

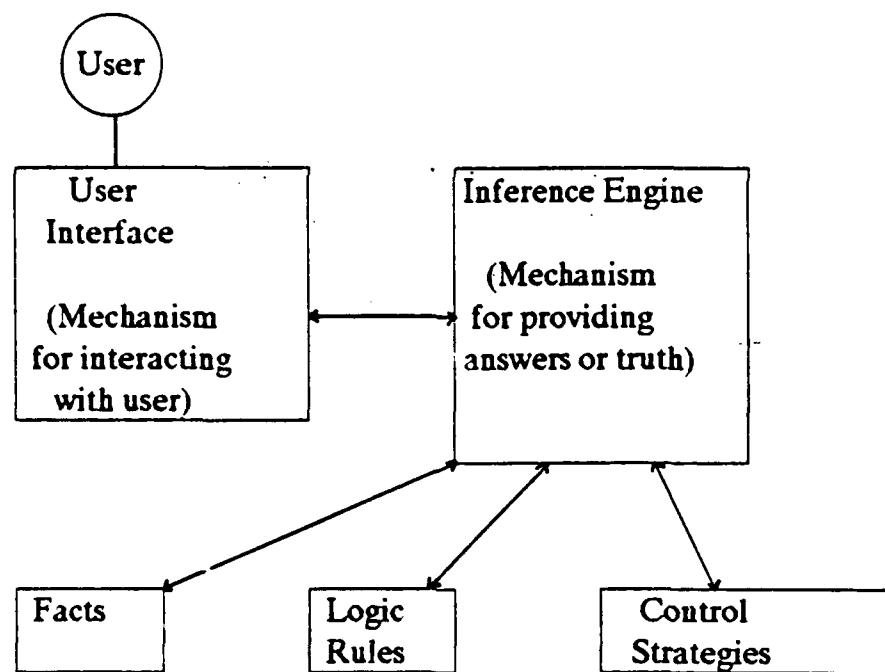


Figure 1. An Expert System

### Expert Systems as Job Aids

Knowledge based systems can be built to function as more than just experts. They can function as assistants, librarians, coaches, tutors, or even job aids (7:18).

According to Carr:

Knowledge-based systems have enormous potential as a way to create "embedded training." That certainly sounds impressive. Here's a less imposing but more familiar name for what we're talking about: job aids. Knowledge-based systems can be used as intelligent job aids, which is the legitimate equivalent of a college student's "crib sheet." It provides the user with a shortcut to accomplish some task. One of the best-known job aids is the checklist that flight crews use before a plane takes off. An airline could train its crews to remember all the steps, and then retrain them (and keep on retraining them) to make sure they don't forget anything. Instead, it simply furnishes them with a checklist that walks them through the steps necessary to ensure that the plane is functioning as it should. (5:42)

An ASM Expert System Job Aid is a tool which would incorporate rich job knowledge about ASM (how it operates, how the user can get around in it, and what references to look up when the user is 'stuck'). It would be an interactive 'checklist' for the maintenance scheduler.

### Summary

The literature confirms ASM has been in an evolutionary stage for fifteen years. The literature mentions that expert systems are powerful new tools used to automate training. There are different types of expert systems, namely traditional rule-based expert systems that rely on production rules in the form of if-then-else statements, and a 'hypertext' expert system which communicates expertise

through 'embedded' knowledge or pictorial schemes. Current trends in training theory suggest that building a rule-based expert system is more difficult than the 'hypertexted' variety, due to inconsistencies in the way experts and novices structure problem-solving strategies. The literature suggests the knowledge-engineer tasks of extracting expertise and creating a good user-system interface be the two top priorities of designing the expert system. Finally, the literature discusses other creative uses for expert systems, to include job aids.

### III. Preparing for the Expert System

#### Overview

The preparation process is divided into four steps. Step one is researcher education. Step two is development of critical questions, and interview selection. Step three is designing the expert system. Step four is verification/validation of the expert system job aid.

#### Researcher Education

The researcher gained knowledge on expert systems and ASM through several means: a comprehensive literature review, an artificial intelligence course at the Air Force Institute of Technology (AFIT), Computer Bulletin Board Services, and discussions with bonafide experts in the field of Artificial Intelligence (19;31). In addition, the researcher conducted interviews with expert maintenance schedulers from TAC (Appendix F), SAC, AFLC, and TAC-gained units on CAMS and ASM training issues. The researcher supplemented these interviews with an intensive self-study of AFM 66-279 and the Automated Scheduling Module via personal computer.

#### Critical Questions

First Question. Which TAC units have received and implemented ASM? HQ TAC/LGQP has not authorized any TAC unit level Plans, Scheduling, and Documentation (P,S and D) sections to implement ASM. The units are unauthorized to

build actual schedules using ASM (34). Maintenance units at McDill AFB FL are conducting tests using ASM and MSgt Thomas is conducting instruction on ASM as part of his 10-day MM325-168 Plans, Scheduling and Documentation course (34).

Second Question. How many TAC schedulers have a working knowledge of ASM? MSgt Thomas said virtually no unit-level personnel have received instruction on ASM or have seen the software before they attend the MM325-168 course. Many of them did not know what the acronym ASM meant. As a result, he offered copies of the ASM software to any student willing to take the program back to use at their respective units.

Third Question. What does ASM provide to the users (i.e. schedules, background products etc.) above and beyond the manual system? ASM provides the functional user with an automated system that generates a flying and maintenance schedule on a monthly, weekly, or daily basis (10:1-1). These products are designed to actually be included in the unit's maintenance plans (Appendix D). ASM builds the schedule in a separate environment from the base level computer. There is virtually no interference from other users or mainframe down time. It can also generate a Time Distribution Index (TDI), an important tool for analyzing the phase flow of the units' aircraft (10:4-1). In the past, the TDI had to be ordered through the base database manager.

These critical questions became the starting point for the knowledge engineering, which led to the expert system development. The knowledge gathered from 392XX personnel and system manuals were then assembled into two separate expert system shells (Appendices C & G).

#### Designing the Expert System

Step one of designing an expert system is identifying the problem domain. This is described in chapter one. The four remaining steps in designing an expert system are: finding an expert, acquiring the expert's knowledge, choosing the right tool (i.e. expert system shell), and encoding the knowledge into the selected tool (33:50).

Expert Selection. MSgt Thomas, Chief, 325th Automated Maintenance Training Branch is the expert for this system. He has been an aircraft maintenance scheduler for over twenty years. He teaches schedulers (primarily from TAC) who will be using ASM on a daily basis. MSgt Thomas is computer literate and has access to computers on a daily basis.

Extracting Knowledge. A personal interview facilitated gathering information for the expert system (Appendix F). The expert detailed scheduler education and decision making. He identified the process used to build an aircraft maintenance and utilization schedule in ASM. Discussions were also held with 392XX personnel from Tyndall, Langley,

Offut, Eaker, and Wright-Patterson AFBs  
(13; 20; 21; 25; 34; 36).

#### Expert System Requirements Determination

VP-Expert and KnowledgePro were the two expert systems shells considered for the ASM Expert System Job Aid. The researcher first used the rule-based shell, VP-Expert. This low-priced shell is excellent for the first time user. This is an easy to use rule-based expert system. It is well suited for anyone wanting a practical familiarity with the subject of expert systems, provides easy development of rules, and interfaces with database applications (33:96). It provides simplified induction of rules, menu selection, and easy control mechanisms. This first system was used to determine the breath and depth needed for this research (33:34,37). KnowledgePro (KP) was examined second. KP provides both a rule-based expert system as well as the hypertext function (32:35; 33:147-148; 35:I-3). The combination of these two concepts provides improved communication. The designer of an expert system controls the level and direction of the information presented, but hypertext allows the user to seek out 'advice' about related factors. For example, if a novice maintenance scheduler is using the expert system and selects the hypertext word 'Time Change Item', a new part of the knowledge base can be called that explains exactly what a 'Time Change Item' is and why it is used. More experienced users would rarely need to ask

for this information and could continue along in the program (35:I-3). KnowledgePro is easy to use and the hypertext is very easy to encode.

KnowledgePro is different from most expert system tools available on microcomputers. It is language-oriented, which makes people initially think it requires extensive programming. However, its architecture lends it to create powerful and imaginative knowledge-based systems with relatively little programming knowledge (33:147).

The program's authors, widely known industry pundits Bev and Bill Thompson, describe KnowledgePro as 'a new kind of communication tool': They report that what excites most people about expert system technology is not the idea of building intelligent machines, but rather the concept of using the computer to communicate expertise (33:282).

By combining the use of 'lists' with the powerful idea of 'topics', KnowledgePro permits the design and building of intelligent systems often without using the if-then-else logic of production rules. If production-rule logic is needed, KnowledgePro includes that syntax as well (33:148).

#### Verification/Validation of the Expert Systems

Both systems will be verified and validated. The researcher will run the programs mechanically to determine if all functions operate correctly without the system crashing (verification). The researcher will also insure that all conclusions reached by the expert system are

"appropriate and that they coincide to the maximum possible degree with the conclusions the chosen expert would reach based on identical information" (26:92; 33:310) (validation). The Expert will also assist in the validation for the final expert system. Other selected 392XX personnel will re-verify and review the chosen system (21; 36).

#### IV. Developing the Expert System

##### Overview

The design process was completed using two different experts systems shells. The first system is a RBES and the second is a 'hypertext' system.

##### System One

System one was developed using VP-Expert version 2.02, a traditional rule-based expert system shell marketed by Paperback Software International (33:110). System one modeled the Initialization and Updating portion of ASM. The system was built using VP-Expert and linked to files created in dBase III. The program allowed the user to associate a particular screen number in ASM with its given function (Appendix C).

System one performed well, but it was very basic (21). However, it did not meet the user-interface needs nor had quite the execution speed for a large knowledge base job aid.'

---

' TSgt Kuntz, spoke of the prototype's possibility for use by reservists who infrequently use their knowledge in the Plans, Scheduling and Documentation section. He considered system one to be an ideal candidate for a Job Aid.

### Interview Session

After developing the basic system one, a series of open ended questions were developed. These questions guided the knowledge gathering process. During this first interview, the line of questioning sought to identify major problems encountered by the Expert while he learned to use ASM (Appendix F).

### System Two

System two uses a hypertext based Expert System Shell. KnowledgePro, a product of Knowledge Garden, Inc. was selected to build the job aid. This shell was selected because of the need to develop intensive hypertext in the system (33:40).

Two earlier knowledge bases demonstrated the power of KnowledgePro. The first knowledge base was created by Flt Lt Paul Pappas, for the Systems Acquisition Management faculty of the AFIT School of Systems and Logistics (27). His project focused on hypertext, menus and the chaining of many files to one another. The second system by Capt Liddle, developed a National Electric Code expert system as part of his thesis research (22).

KnowledgePro deals with large volumes of data much easier than VP-Expert. This was very advantageous, since the ASM Job Aid knowledge base is quite large.

KnowledgePro also has a run-time version of software. This makes it easy to transport the expert system around the Air Force.

KnowledgePro was not a difficult system to learn. The sample knowledge bases provided with the software outline excellent examples on how to utilize and build your own program. The central structure in KnowledgePro is the 'topic'. The nine basic commands surrounding its use are very easy to understand (33:148).

A considerable amount of information was extracted from AFM 66-279 using a DEST light scanner, model 202. This made the job of knowledge transferring easier. By using the scanner, the researcher was able to condense a 92 page manual onto a floppy disk of 93 kilobytes (storage space). The researcher added additional 'expertise', mined from the Expert, to the AFM 66-279 knowledge base. This process basically completed the creation of the first job aid prototype.

Facsimile ASM screens were built and included hypertexted information. This design provides a multi-layered job aid that can help the novice user of ASM. With the hypertexted system, the scheduler can access those hypertexted words, which gives a deeper definition, or more detailed information about the subject.

### Validation Session

The Expert reviewed the prototype of system two. On-the-spot corrections were made, but it was not plausible to validate the system in totality. The updated knowledge base was again demonstrated to the Expert who validated the system as being correct and logical. The Expert also allowed three of his students to verify the ASM Expert System Job Aid. These students, with no prior ASM experience, tested the job aid to insure each function operated properly. Each student went through the entire job aid and was very encouraged by the production of such a tool. Their initial exposure to the system found it worked as advertised.

The Expert provided the most valuable information on improving the system. His comments suggests colors changes, deletion of certain numbers which he felt were extraneous, etc. (Appendix E). His comments enabled continuing improvement of the system.

Additional schedulers from Wright-Patterson AFB OH evaluated the system after these improvements were added. (21; 36). This evaluation consisted of reviewing the ASM Job Aid for correctness and logic, as well as reviewing the overall user-system interface. Schedulers were convinced the job aid had great potential as a training tool.

### Overall Success

"The ASM Expert System Job Aid is a successful training instrument" (21; 34; 36). It has gone through several levels of review with continued improvement at each step. The Expert has reviewed the system twice, students taking the P,S, and D MM325-168 course and schedulers at Wright-Patterson AFB have reviewed the system once. User comments suggest the system is needed due to its interactiveness, potential to be modified, and overall good user-interface (21; 34; 36).

## V. Conclusions

### Overview

Evaluation of the system found that the ASM Expert System Job Aid appears to contribute as an enhanced training aid for the novice maintenance scheduler. The Job Aid has gone through four levels of review with continued improvement at each step. It was successfully developed and has reaped very favorable reviews. The novice scheduler appears to have value-added from the system, and should be able to use ASM more efficiently by using the ASM Expert System Job Aid.

### Recommendations

1. The Air Force Logistics Management Center, Gunter AFB AL should examine System two, the ASM Expert System Job Aid. It provides a significant contribution to the ASM Performance Support System they have projected to create for the maintenance scheduler (Appendix B).
2. TAC should provide 392XX personnel a copy of the ASM Expert System Job Aid before they attend course MM325-168. The current run-time version is contained on one 5.25" disk and the ASM Expert System Job Aid with associated tutorials for using KnowledgePro could be provided on a second disk.
3. It is recommended job aid copies are sent from MAJCOM ASM functional offices to field units, already using

ASM. They can review the system and provide inputs to increase the knowledge base.

4. Lessons learned from SAC counterparts which have successfully implemented ASM should be circulated to all applicable units.'

---

' When the research project started, the 97th SRW P, S, and D section, Eaker AFB was the only SAC unit to have implemented ASM. Today, P,S, and D sections at March, Grand Forks, Wurtsmith, and Offutt AFBs have joined the ranks of those actively using ASM. As of 27 Aug 1991, the Tactical Air Command had not elected to fully implement ASM at the unit level. There is, however, more interest in the product Air Force wide as all 3-levels will now receive some ASM training when they attend the entry level AFSC-awarding course.

## Insight

Hypertext value-added. The combination of using hypertext within the ASM program would be beneficial to insure better training of scheduler personnel. The on-line help system is already in ASM. By adding hypertext, the scheduler would be able to move easier, and more naturally through ASM. This function would give the user more control over the system and result in better trained maintenance schedulers.

By adding this 'embedded knowledge' to the system the formal training effort (i.e., time) should be drastically reduced. This would provide 'true' On-the-Job potential for the system.

If well suited for the field, a product of this type could save an enormous amount of TDY expenses, since it would eventually eliminate the need for personnel who currently travel to Tyndall AFB FL strictly for ASM training.'

---

' Members of the 97th Strategic Bombardment Wing, P,S, and D section, Eaker AFB AR are actively using ASM to generate schedules and use them in the submission of the weekly, and monthly schedules. They enjoy great success by using ASM, and do not seem to have major interface problems with CAMS. This unit has received no formal training in ASM.

Manning Issues. Expert Systems will increasingly impact critical manning issues the Air Force is now facing. As the 'drawdown' continues, experienced people, including maintenance schedulers, will leave the service. As they exit, the knowledge they possess will leave with them.

A product, such as the ASM Expert System Job Aid can easily prevent this knowledge loss. Since, it can be easily modified, new knowledge could always be 'captured'. This would insure the most current 'expertise' stayed within the unit to be used by incoming personnel. The following example clearly illustrates the job aid potential: On 12 Aug, Lt Col Rick Bereit, Assistant Deputy Commander for Maintenance, Spangdahlem AB Spain reported that his unit had several 392XX personnel losses due to PCS. These schedulers played a key role in the organization, and maintenance scheduling effectiveness suffered as a result (2). An expert system job aid would diminish the 'void' left by those schedulers and would ensure the knowledge base of those departing schedulers remained at that unit'.

---

' A copy of the ASM Expert System Job Aid was given to Lt Col Bereit for evaluation by schedulers within his unit.

AF Stock Fund Policy to Influence ASM. In October of 1992, customers (i.e. wing commanders) will pay for AF stock fund depot level reparables (DLRs) with O & M funds (8:18). Maintenance managers will no longer be able to afford an excess of 'anticipated' items. Maintenance schedulers, using ASM, will need to track and properly forecast for high dollar inspections.

ASM Overall Impact. ASM has the potential to yield significant savings for the wing commander at base level. It produces real-time management products such as the Time Distribution Index (TDI) which forecasts major maintenance actions (i.e. Phase Inspections, TCTOs etc.) (10:1-1).

With information being more real-time, ASM is crucial to provide better forecasting of major inspections. This will allow a higher probability of knowing when major expenses will occur and subsequently better management of AF Stock Funds can happen.

The result: 1) Unnecessary high dollar items will not be ordered. 2) Hundreds of thousands of dollars in savings will accrue if schedulers use ASM to better predict periods of high maintenance costs. ASM will then provide significant value-added, as it should prevent complacency among logistics managers who must 'pay' for DLRs. ASM will contribute not only to the flying, training, and maintenance missions. It may well be the cornerstone of a successful AF Stock Fund program at base level.

## Appendix A: Inspection System Definitions

### PHASED INSPECTION CONCEPT

The phased inspection concept is actually a combination of the basic postflight and/or hourly postflight and periodic inspection requirements into small packages. These packages have approximately the same work content and clock hours. Lumping these three inspections into one would make an inspection that requires an extremely long time to complete. Therefore, this inspection is broken into parts or phases. Phase 1 is at 50 hours, phase 2 at 100 hours, phase 3 at 150 hours, etc., with phase 12 at 600 hours. At 650 hours, the sequence would start again with phase 1, and the cycle would repeat itself indefinitely.

One of the main objectives of the phased concept is to reduce the time the aircraft is out of commission for any given inspection. The phases are arranged in such a manner that each requires approximately the same number of man-hours. This arrangement permits all inspection requirements to be met with a short out-of-commission time for any one phase.

The headings at the top of workcards provide some rather important information. By reading the information in the heading blocks, we know the card number, the work area, the publication number and date, the type mechanic required to perform the work, and whether or not the electrical power must be on or off. Also, we can tell in which phase or phases these particular items must be inspected.

### ISOCHRONAL INSPECTION CONCEPT

The isochronal inspection concept is designed to translate flying hour utilization rates into calendar periods, usually expressed in days. The system manager is responsible for ensuring the calendar period is properly established to meet maintenance and engineering requirements, and that it is adjusted when basic utilization rates change.

The scheduling program should be constructed to allow for the time that an aircraft is programmed to be in inspection status. For example, if an aircraft is programmed to be in inspection status for 3 days and the calendar inspection period based on the utilization rate is 70 days, the inspection would be scheduled each 73 days. This should be established as the inspection interval for this particular aircraft and the schedule based on the programmed input date for the first inspection.

## PERIODIC INSPECTION CONCEPT

Periodic Inspection. The periodic inspection is a thorough and searching inspection of the entire aircraft, more extensive than the hourly postflight or basic postflight inspections. In addition to the recurring inspection items, some of which are required at the hourly postflight inspections, the periodic inspection includes certain components, areas and systems of the aircraft that require less frequent inspection (because of their function) than the hourly postflight or the basic postflight.

The periodic inspection is considered due when the specified number of flying hours or calendar period had expired. As is the case of the hourly postflight, the aircraft should not be scheduled for flight if the mission will overextend the inspection by too great a margin.

Hourly Postflight. The hourly postflight is accomplished after a specified number of flying hours have accumulated. It consists of checking certain components, areas and systems of the aircraft to make sure that no conditions exist which could result in failure of the component before the next scheduled inspection. This inspection augments the basic postflight. In fact, the basic postflight is often accomplished at the same time. For example, if an aircraft has flown and has also accumulated the specified number of hours for the hourly postflight, then the hourly postflight and basic postflight will be accomplished at the same time.

Appendix B: Cover Letter

RTTAO: AFLMC/LGM

2 Jan 91

Subject: Automated Scheduling Module (ASM II) - Performance Support System

TO: AFIT/LSG (Capt Kevin Gore)

Kevin,

Here's the ASM disks and documentation that accompanied the Worldwide release of ASM II in December, 1990. ASM consists of seven disks, six disks containing the program files and one containing a sample data file for a KC-135 aircraft.

We have done some initial testing of the program here at the AFLMC, and from what I have seen of the program, it is the ideal candidate for a performance support system. The program is usable (that's the good part), but in keeping with the rest of CAMS, the user interface leaves much to be desired. It does have data field helps on-line, but once you start using the program, you'll find that the data field help information is of limited use.

Just to tickle your memory about the PSS, what we would like you to develop a performance support system around ASM. It should provide training for the novice user, advice on how to use the system for the intermediate user (an expert system), and on-line documentation for the expert user.

The instructions to load ASM are in the documentation I've included. One word of caution, however. We found that ASM is a memory hog (It's written in MS-Cobol to be compatible with CAMS). It takes 590K of memory, which pushes the limits of MS-DOS. While you're running ASM, you can't launch anything else. However, as long as you close ASM before doing any other task, you'll be O.K.

Kevin, what we would like you to do is evaluate ASM with an eye for building a PSS. You might want to start by building a small program, based on a part of ASM, for your modeling or DSS class. After my initial assessment of ASM, I still believe this is very 'do-able' research. Not only will this project provide you with a GREAT thesis, but it will provide a worthwhile service to the aircraft maintenance community.

In any case, the ball's now in your court. After you've made your final decision please call so we can get the ball rolling on doing the formal sponsor paperwork (we'll need to do this to support future TDYs and purchase upgrades for KnowledgePro).

Please respond NLT 7 Feb 91. If you need to call me for any further information or have any further questions, my DSN number is 446-4581.

DAVID P. MARTIN, Capt, USAF  
Logistics Study Project Manager.  
Director of Maintenance, AFLMC

## Appendix C : System One Source Code

```
! KNOWLEDGE BASE; SELECTION OF SCREENS IN THE UPDATING
! PORTION
! OF THE AUTOMATED SCHEDULING MODULE (ASM)
! FILENAME: SELECT.KBS
! REVISION DATE: 19 FEBRUARY 1991
! AUTHOR: CAPT KEVIN GORE
! DESCRIPTION: This expert system will assist novice
! schedulers in the selection of the appropriate ASM
! screen numbers, used to update databases for the
! eventual processing of Automated schedules. The
! information is from AFM 66-279, 1 Dec 90,
! Core Automated Maintenance System (CAMS) DSD: G)54/F5,
! Automated Scheduling Module (ASM) End User Manual
```

```
! VPX Release 2.02
AUTOQUERY;
RUNTIME;
ENDOFF;
```

```
BKCOLOR = 2;
! *****Actions
Block*****
```

### ACTIONS

```
COLOR = 21
WOPEN 1,6,12,10,50,1
ACTIVE 1
```

```
DISPLAY "
```

```
        WELCOME TO THE
        ASM UPDATE/INITIALIZATION MODULE!
```

```
        Version 1.0
```

```
        (PRESS ANY KEY)~"
```

```
color = 21
CLS
WCLOSE 1
WOPEN 2,5,5,12,70,1
ACTIVE 2
DISPLAY
```

"  
THIS EXPERT SYSTEM WILL ASSIST NOVICE SCHEDULERS IN THE  
SELECTION OF THE APPROPRIATE ASM SCREEN NUMBERS, USED  
TO UPDATE DATABASES FOR THE EVENTUAL PROCESSING OF  
AUTOMATE SCHEDULES. THE INFORMATION IS DERIVED FROM  
AFM 66-279, 1 DEC 90, CORE AUTOMATED MAINTENANCE SYSTEM  
(CAMS) DSD:G)54/F5 AUTOMATED SCHEDULING MODULE (ASM)  
END USER MANUAL.

(PRESS ANY KEY)~"

cls  
DISPLAY "

AUTOMATED SCHEDULING HAS FOUR MODULES:

\*\* THE UPDATE INITIALIZATION MODULE \*\*  
\*\* THE SCHEDULE GENERATION MODULE \*\*  
\*\* THE SCHEDULE PRINT MODULE \*\*  
\*\* THE UTILITY MODULE \*\*

(PRESS ANY KEY)~"

cls  
WOPEN 4,2,5,15,70,1  
ACTIVE 4

DISPLAY "

WELCOME TO THE UPDATE INITIALIZATION TUTORIAL

IN TOTAL, THERE ARE 21 SEPARATE SCREENS USED FOR THE  
UPDATE AND INITIALIZATION MODULE. SCHEDULERS MUST BE  
FAMILIAR WITH ALL SCREENS AND UNDERSTAND THE SCHEME OF  
THESE SCREENS IN RELATION TO THE ENTIRE AUTOMATED  
SCHEDULING PROCESS.

(PRESS ANY KEY TO CONTINUE)

~"  
cls  
WCLOSE 4

```

MENU AREA, ALL, c:\dbase\TERMS,SCREEN
cls

find question
find name
find user
FIND STUDENT
FIND UTIL
FIND AREA
WHILETRUE SCREEN<>(AREA) THEN
GET screen= tric, TERMS,all
end
wopen 5,1,1,20,77,2
active 5
DISPLAY " THIS SCREEN :{FUNCTION}.

THE SCREEN NUMBER IS {NAME}.

KEY FEATURES AND/OR DEFAULTS: {DEFAULTS}

THIS PARTICULAR MODULE IS USED FOR {MODULE}.

(PRESS ANY KEY)~"
wclose 5

```

```

COLOR=31
WOPEN 6,1,5,5,58,4
ACTIVE 6
DISPLAY "THANK YOU FOR USING THE AUTOMATED SCHEDULING
MODULE."
DISPLAY "(PRESS ANY KEY TO EXIT THE PROGRAM)

~"
WCLOSE 6
WCLOSE 4

;
*****RULES
BLOCK*****
RULE 1
IF question=yes
and NAME=asm#93
then user = smart
cls
display " Super, so you realize you're in the
(UPDATING) module CNF 92.
(PRESS ANY KEY)~";

```

```
RULE 1A
IF question=no
and NAME=asm#93
then user = not_smart
cls
    display " Well, this program is just for you!.
(PRESS ANY KEY)~";
RULE 2
IF question=yes
and NAME=asm#86
then user = smart
cls
    display " Super, so you realize you're in the (UTILITY)
module CNF 92.
(PRESS ANY KEY)~";
rule 2A
if question=no
and NAME=asm#86
then user = not_smart
cls
    display " Well, this program is just for YOU!
(PRESS ANY KEY)~";

rule 3
IF question=yes
and NAME=asm#14
then user = smart
cls
    display " Super, so you realize you're in the
(UPDATING) module CNF 92.
(PRESS ANY KEY)~";
rule 3A
IF question=NO
and NAME<>asm#14
then user = NOT_SMART
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 4
IF question=yes
and NAME=asm#15
then user = smart
cls
    display " Super, so you realize you're in the
(UPDATING) module CNF 92.
(PRESS ANY KEY)~";
rule 4A
IF question=NO
and NAME=asm#15
then user = NOT_SMART
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
```

```
rule 5
IF question=yes
and NAME=asm#16
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";
rule 5A
IF question=NO
and NAME=asm#16
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 6
IF question=yes
and NAME=asm#10
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 6A
IF question=NO
and NAME=asm#10
then user = NOT_SMART
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 7
IF question=yes
and NAME=asm#12
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 7A
IF question=NO
and NAME=asm#12
then user = not_SMART
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
```

```
rule 8
IF question=yes
and NAME=asm#11
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 8A
IF question=NO
and NAME=asm#11
then user = NOT_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 9
IF question=yes
and NAME=asm#64
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 9A
IF question=NO
and NAME=asm#64
then user = NOT_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 10
IF question=yes
and NAME=asm#42
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 10A
IF question=NO
and NAME= asm#42
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
```

```
rule 11
IF question=yes
and NAME=asm#42a
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 11a
IF question=no
and NAME=asm#42a
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 12
IF question=yes
and NAME=asm#42b
then user = smart
cls
    display " Super, so you realize you're in the
(UPDATING) module CNF 92.
(PRESS ANY KEY)~";

rule 12a
IF question=no
and NAME=asm#42b
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 13
IF question=yes
and NAME=asm#45
then user = smart
cls
    display " Super, so you realize you're in the
(UPDATING) module CNF 92.
(PRESS ANY KEY)~";

rule 13a
IF question=no
and NAME=asm#45
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
```

```
rule 14
IF question=yes
and NAME=asm#92
then user = smart
cls
    display " Super, so you realize you're in the
(UPDATING) module CNF 92.
(PRESS ANY KEY)~";

rule 14a
IF question=no
and NAME=asm#92
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 15
IF question=yes
and NAME=asm#96
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 15a
IF question=no
and NAME=asm#96
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 16
IF question=yes
and NAME=asm#90
then user = smart
cls
    display " Super, so you realize you're in the
(UPDATING) module CNF 92.
(PRESS ANY KEY)~";

rule 16a
IF question=no
and NAME=asm#90
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
```

```
rule 17
IF question=yes
and NAME=asm#83
then user = smart
cls
    display " Super, so you realize you're in the
(UPDATING) module CNF 92.
(PRESS ANY KEY)~";

rule 17a
IF question=no
and NAME=asm#83
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 18
IF question=yes
and NAME=asm#83a
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 18a
IF question=no
and NAME=asm#83a
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 19
IF question=yes
and NAME=asm#13
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 19a
IF question=no
and NAME=asm#13
then user = not_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
```

```
rule 20
IF question=yes
and NAME=asm#81
then user = smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";

rule 20A
IF question=NO
and NAME=asm#81
then user = NOT_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 21
IF question=yes
and NAME=asm#82
then user = smart
cls
    display " Super, so you realize you're in the
(SCHEDELE_PRINT) module CNF^G89.
(PRESS ANY KEY)~";

rule 21A
IF question=NO
and NAME=asm#82
then user = NOT_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 22
IF question=yes
and NAME=asm#84
then user = smart
cls
    display " Super, so you realize you're in the
(SCHEDELE_PRINT) module CNF^G89.
(PRESS ANY KEY)~";

rule 22A
IF question=NO
and NAME=asm#84
then user = NOT_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
```

```
rule 23
IF question=yes
and NAME=asm#84a
then user = smart
cls
    display " Super, so you realize you're in the
(SCHEDULE_PRINT) module^GCNF 89.
(PRESS ANY KEY)~";

rule 23A
IF question=NO
and NAME=asm#84a
then user = NOT_smart
cls
    disPlay " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 24
IF question=yes
and NAME=asm#92
then user = smart
cls
    display " Super, so you realize you're in the (UTILITY)
module CNF 87.
(PRESS ANY KEY)~";

rule 24A
IF question=NO
and NAME=asm#92
then user = NOT_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
rule 25
IF question=yes
and NAME=asm#87
then user = smart
cls
    display " Super, so you realize you're in the (UTILITY)
module CNF 87.
(PRESS ANY KEY)~";

rule 25A
IF question=NO
and NAME=asm#87
then user = NOT_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
```

```
rule 26
IF question=yes
and NAME=asm#93
then user =smart
cls
    display " Super, so you realize you're in the (UPDATING)
module CNF 92.
(PRESS ANY KEY)~";
```

```
rule 26A
IF question=NO
and NAME=asm#93
then user =NOT_smart
cls
    display " Well, this program is just for you!
(PRESS ANY KEY)~";
RULE 27
IF STUDENT >= 14
THEN UTIL =(STUDENT/30)
CLS
DISPLAY
"UTILIZATION IS {UTIL} AND HIGH. LOOKS LIKE YOU'VE BEEN
HITTING THE BOOKS!
PRESS ENTER TO CONTINUE PROGRAM.~";
```

```
RULE 27a
IF STUDENT <= 12
THEN UTIL = (STUDENT/30)
CLS
DISPLAY
"UTILIZATION IS {UTIL} AND LOW. SPEND SOME MORE TIME IN THE
BOOKS.
PRESS ENTER TO CONTINUE PROGRAM.~";
```

```
RULE 27B
IF STUDENT = 13
THEN UTIL =AVERAGE
CLS
DISPLAY
"UTILIZATION IS AVERAGE.
PRESS ENTER TO CONTINUE PROGRAM.~";
```

ASK AREA: " WHICH SCREEN NAME WOULD YOU LIKE HELP WITH TODAY?";

ASK NAME: "IF YES, SELECT SCREEN NUMBER. IF NO, SELECT ANY?";

CHOICES NAME:  
ASM#93,ASM#14,ASM#15,ASM#86,ASM#16,ASM#10,ASM#12,ASM#11,ASM#64,  
ASM#42,ASM#42A,ASM#42B,ASM#45,ASM#92,ASM#96,ASM#90,ASM#83,AS  
M#83A,ASM#13,ASM#81,ASM#82,ASM#84,ASM#84A,ASM#92,ASM#87,ASM#  
88;

ASK MODULE: "Which of the four option are you now in?";

CHOICES MODULE: UPDATING,SCHEDULE\_PRINT\_,UTILITY,print;

ask question: "Does user have a specific SCREEN NUMBER in mind (I.E. ASM#)?";

choices question: yes,no;

ask user: "Is user smart? (MUST type YES or NO FOR QUESTION 1).";

choices user: smart, not\_smart;

plural: user, STUDENT;

ASK STUDENT:" ON AVERAGE, HOW MANY DAYS PER MONTH DO YOU USE THE TUTORIAL?";

range student: 1,30;

Appendix D: Sample 97th SBW Weekly Plan

**97th Bombardment Wing**

>>>> A STEP ABOVE THE REST <<<<

WEEKLY MAINTENANCE PLAN
17 JUNE - 23 JUNE 1991

**EAKER AFB, AR.**



THIS MAINTENANCE PLAN HAS BEEN REVIEWED  
BY MAINTENANCE SUPERINTENDENTS :

ONS Robert J. Duff

FMS Robert J. Duff

MMS John T. Thomas

<u>William J. Fagan</u> Wing Commander	<u>Thomas J. Patterson</u> Deputy Commander for Maintenance	<u>John S. Glass</u> Deputy Commander for Operations
---	--	---

TIME 10:30

AUTOMATED SCHEDULING MODULE

DATE 13 JUN 91

WEEKLY/DAILY AIRCRAFT UTILIZATION SCHEDULE : UNIT: 97 BPN : MDS: B052 : DAY/DATE: MON/17 JUN 71 : PAGE 1

THE 10:31

#### **AUTOMATED SCHEDULING MODULE**

DATE 13 JAN 91

## Appendix E: Recommendations from Prototype Session

Tyndall AFB, FL, 3 Aug 91

### Recommendations:

1. **Suggestion:** Remove actual references from AFM 66-279 throughout the body of the job aid, except in Table of contents. (i.e. instead of showing "4.3.3 Main Menu, Screen ASM #82" replace with "Main Menu, Screen ASM #82")

**Reason:** Numbers before title will not mean much too the user.

**Disposition:** C/W

2. **Suggestion:** Center all textual material.

**Reason:** Material is much easier to read.

**Disposition:** C/W

3. **Suggestion:** User should be able to return to the item selected after finishing that particular item.

**Reason:** Enables the user to keep better track of where he/she is in the program, especially if in option 5A.

**Disposition:** OPEN

4. **Suggestion:** Include a quiz after each section; and if user doesn't answer appropriately, he cannot continue in the program, or he has to go back and review that particular section.

**Reason:** Provides more interaction and provides a learning tool to enable the student to better understand ASM.

**Disposition:** OPEN

5. **Suggestion:** Display a TDI that was actually produced in ASM.

**Reason:** It would allow students to view one of the more important features of ASM (i.e. a picture is worth a thousand words).

**Disposition:** OPEN

6. **Suggestion:** Text colors need changing (i.e. suggested white or yellow for text, and does not recommend flashing red).

**Reason:** Enables the user to read easier and longer period of time with less eye strain.

**Disposition:** C/W

## Appendix F: Interview Session

This memo is written on 10 May 91 to confirm some of my findings during my TDY to Tyndall AFB, FL from 8-10 May 91.

Day one started at 0830 and lasted until 1600 with a break for lunch between 1200-1330. Day two started at 0900 until 1200. I came back to review my notes and write up the trip report between 1215 and 1400. I met MSgt John J. Thomas, Branch Chief, Automation Management Training Center, 325 MTS, Tyndall, AFB, FL.

First order of business was introductions. Basically, I told him about the project. I explained that I was interested in becoming familiar with ASM (become a pseudoexpert) to proceed with my Thesis work, which has been chartered as creating an expert system, or building a Performance Support System to benefit new/novice users of the Automated Scheduling Module (ASM). As I explained to him, my main purpose was to expedite my understanding of the ASM system, and to test my KC135 database, which I previously was unable to initialize at home station.

I demoed the prototype I had created using the VP-expert shell, specifically mentioning its linkage with the database using d-base III. I briefly explained to him that I was the knowledge engineer, and he was the domain expert. I captured most of his expertise via asking him questions as he sat behind the CRT and explained the different facets of ASM. We talked about a pre-processor (front-end) versus a post-processor (back end), and he explained that he felt our present emphasis being a front-end was appropriate. We also talked about terminology. He explained that a great deal of the terms (i.e TDI, PRA etc.) should be familiar to the students, because they have been exposed to them in Tech School. I mentioned that I would like to put a majority of the words in hypertext, which I explained was like a dictionary, whereby the user, by the use of a mouse, or cursor could highlight a word, or term he wasn't familiar with and hit enter, whereby an explanation of that term would appear. We took a look at MSgt Thomas' AUTOEXEC.BAT, and CONFIG.SYS files which were similar to mine. The ANSI.SYS we took a look at on day 2. But, we got nothing but ASCII code. We talked about speed of ASM on the 386 vs the 286, but he has nothing but 286s, so no comparison could be made. My guess is that a 386 will speed up the processing \* note \* I mentioned that I may load up my program on a friend's 386 to see if the processing speed changes significantly. Thomas mentioned that it takes 30-50 min to generate a monthly schedule using 26 a/c (F-15, F-16). \* note \* the fighter type aircraft have significantly more scheduled maintenance than do the some of the heavier birds. So far, I base that statement on viewing information from the KC135, F-16, and F-15 databases. The fighters have quite a few time change items (i.e. parts on the ACES II) versus the heavier-type aircraft.

One significant note to mention is that you must be using CAPS to work in ASM. This fact is, however, mentioned in Vol. 21. ASM does not track cycles, or rounds. It only tracks hrs, days, and months. It cannot know how many cycles of an engine the pilot flew etc. (those types of inspections/requirements are scheduled using the "special" events screen; there is a method to get the EHR information, but don't utilize it in conjunction with ASM. Schedulers also track such items such as gun maintenance separately in the "Special" events screen. On some screens, there is a selection for F for Flightline or D for Dock -- it turns out that its really F, for other than Dock. The warning "Action code must be Unique" really means it has already been used. After initialization of all job standards, TOP OF FILE appears meaning you are finished with initialization of all job standards (loading job standards is just one part of initialization).

Screen #92 FIELD CANNOT BE ZERO refers to inputting a zero for turn time. Thomas has filled out ASM #92, ESC key used to save instead of F10. \* note \* you may want to view all screens to see which have similar uses of different function keys. TCTO parameters screen used 80 hrs. to assign, but on the first pass it didn't kick out, and it even printed 80 hours on the printout. The second time, we went to change the 80, it did show the warning " cannot use more than 24 hours" [sic]. ASM#88 is really the "Special" Events screen. Noticed that Thomas' Vol 21 had more pages listed than I did - mine actually has the same number. Thomas gave me the F-16 files and explained how to access them. Let's go step-by-step to get it right. He downloaded the F-16 and D-I subdirectories onto a floppy disk. \* note \* there is a lot of information in the system, but apparently when you download CAMS data to a floppy or download directories from an ASM database, it compresses the files. He used the RESTORE command to put the data downloaded from the F-16 directories on one machine onto the machine we were working on. He used the RESTORE A:.\* C: to take those files from a and put them back onto C:. He showed me the #509 CAMS screen used for downloading CAMS information to a floppy or hard drive (whichever you choose) in order to have "current" info to be used by ASM. He mentioned that it will usually take several minutes to begin processing - in our case, it took about 3 minutes. It took about 24 minutes for all of the information we requested to actually be downloaded into the floppy. Another tidbit, he mentioned screen #469 which should be used by supervisors to check if their workcenter requirements have been completed.

Back to ASM, he mentioned that on Screen #92, mission blocks are used (3) for TAC aircraft because they take off as flights routinely. Mentioned option #3 on generating a weekly has capability for surges. ASM #85, 2436 is primarily for MAC, and SAC aircraft. Grid is for ATC and TAC uses the 297. He mentioned that ASD (average sortie duration is a key player in converting hours to sorties or vice-versa. When inputting the F-16s into the system, you must: space, space F016C space

(--F016C-) for it to initialize properly. Mentioned the fact that warnings such as file 5C corrupted refers to an "unclean" CAMS database when trying to download data from screen #82.

Appendix G: System Two Source Code

(\* ASM JOBGUIDE

THESIS PROJECT

8 AUG 1991\*)

no\_debug ().  
no\_edit\_key ().

say ('

MSgt John J. Thomas  
Branch Chief

Automation Management Training Center  
325th Maintenance Training Squadron  
Tyndall AFB, Florida

#FRED WELCOMES YOU TO THE #MASM EXPERT SYSTEM JOB AID#m

- one more page -

#fwhite This program was developed for Plans, Scheduling, and Documentation Personnel. It assumes you have access to a computer and have basic skills in using MS-DOS commands. It was designed to improve the transition from manual to automated scheduling.

The program was written using KnowledgePro (KPRO). KnowledgePro is an #mexpert system shell#m. Disk # 1 has a run-time version of KPRO. This batch file will create a sub-directory called C:\GARDEN, unless one already exists, uncrunch the files and copy them to the directory.

There are two knowledgebases (A:\USING.CKB and A:\ASMJOB.CKB.) on disk # 2. USING.CKB is a tutorial program for KPRO. Looking at USING.CKB will help speed the user through any application created in KPRO.

You can choose to use the knowledgebases from the floppy disk drive, or you can install them to the C:\GARDEN directory by using the COPY A:\\*.CKB command at the C:\GARDEN prompt.

Press #fyellow SPACE#d to continue').

```

do ('select method').
topic 'select method'.
selection is ['1. Table of Contents', '2. Section One (General)',
             '3. Section Two (System Summary)',
             '4. Section Three (Access to the System)',
             '5. Introduction to the ASM Job Guide',
             '5A. SECTION FOUR, PROCESSING REFERENCE GUIDE',
             '6. Return to ASM','Exit'].

ask ('      #fyellow Option one allows reference to actual item
listing(s) & page number(s) from AFM 66-279. This should give you
an idea of which section lists the appropriate reference you may
need. Options 2,3,4, and 5A, take you to their appropriate menus,
option 6 returns the user to ASM (NOTE: If you choose option 6,
you may return to KnowledgePro by typing "return" at the C:\ASM
prompt). In order to use the "return" from ASM you must copy the
A:\RETURN.BAT file to C:\ASM. AT the C:\ASM prompt, type COPY
A:\return.bat. EXIT, causes you to leave the program.

Please make your selection!#d',choice,?selection).if
?choice <> 'Exit'
then do (?choice).
end. (* select method *)

topic '1. Table of Contents'.

section is ['Table of Contents - From Start to Finish', 'Quit'].

ask (
#fyellow
      The table of contents is a relatively short section.
      There are only seven pages. Use the PgDn and PgUp keys to
      view the entire contents.

      Choose Table of Contents - From Start to Finish. Now!
      On completion hit the space bar or enter to return to this menu.

      Choosing #fbrown Quit#d takes you back to the previous
menu.#d',see,?section).

if ?see <> 'Quit'
then do (?see)
and do ('1. Table of Contents')
else do ('select method').

end. (* Table of Contents *)

```

```

topic '2. Section One (General)'.
contents is ['Quit','Purpose of the End User Manual','Purpose of
the System',
            'References','Terms and Abbreviations','Sensitivity',
            'View All-1'].

ask (
#Fyellow
    Section One is a relatively short section. If you select
    View-All you can scroll through the entire section rather than
    viewing one section at a time.

    Choose your selection Now!

On completion hit the space bar or enter to return to this menu.

Choosing #fbrown Quit#d takes you back to the previous menu.#d',
look,?contents).

if ?look <> 'Quit'
then do (?look)
and do ('2. Section One (General)')
else do ('select method').
end. (* 2. Section One (General) *)

topic '3. Section Two (System Summary)'.
read is ['Quit','View All-2','Applications
Summary','Performance','Controls',
        'Hardware Required','Software Required',
        'Contingencies and Alternate modes of Operation',
        'Assistance and Problem Reporting'].

ask (
#fyellow
    Section Two covers an Overview of ASM and explains about
    the System Environment. It is also relatively short and by
    selecting "VIEW ALL", you can scroll through the entire section
    rather than each sub-section.

    Please choose your selection!
On completion, hit the space bar or enter to return to this menu.
Choosing #fbrown Quit#d takes you back to the previous menu.#d',
now,?read).

if ?now <> 'Quit'
then do (?now)
and do ('3. Section Two (System Summary)')
else do ('select method').

end. (* 3. Section Two (System Summary) *)

```

```
topic '4. Section Three (Access to the System)'.
number is ['Quit','View All-3','First-Time Use of the System','Equipment
Familiarization','Access Control','Installation and
Setup','Hard Disk Partitioning','ASM
SubDirectories','Loading ASM System Software',
'Initializing the ASM Database','Initiating a Session',
'Stopping and Suspending Work'].
```

```
ask (
    #fyellow
        Section Three covers gaining Access to the system.
    Again, it is a relatively short section, and may be viewed in
    its entirety by selecting "VIEW ALL".
```

Choose your selection, Now!

On completion, hit the space bar or enter to return to this menu.  
Choosing #fbrown Quit#d takes you back to the previous menu.#d',  
summer.?number).

```
if ?summer <> 'Quit'
then do (?summer)
and do ('4. Section Three (Access to the System)')
else do ('select method').
end. (* 4. Section Three (Access to the System) *)
topic '5. Introduction to the ASM Job Guide'.
say (
#fyellow
```

Section Four is the GUTS of the ASM Job Guide. You can access  
actual references from AFM 66-279, "hypertexted" information from  
the Schedulers Guide to Plans, Scheduling and Documentation, and  
ASM screen facsimile displays.

#flightcyan ALL SELECTIONS THAT HAVE AN (\*) HAVE A SCREEN DISPLAY,
SELECT F4 AT THE VERY FIRST HYPERTEXTED ITEM TO VIEW THE SCREEN.
THIS FEATURE SHOULD ENABLE THE USER TO BECOME FAMILIAR WITH THE
ASSOCIATED SCREENS!

#fred

NOTE: TO VIEW THE ENTIRE SCREEN, HIT THE SPACE BAR OR ESCAPE
TWICE AFTER PRESSING THE F4 KEY#d

REMEMBER, GO TO THE NEXT ITEM (5A) BEFORE SELECTING!').
do ('select method').
end.

```
topic '5A. Section Four, Processing Reference Guide'.
```

```
contents is ['Quit','View All-4','Capabilities','Conventions','Processing Procedures',
'Automated Scheduling Update, NFS2V0, CAMS Screen #509',
'*MDS Selections Menu, Screen ASM #81*',
'*Main Menu, Screen ASM #82*', '*Update ASM Database*',
'Initialize ASM Database from CAMS Download Data',
'Initialize the ASM Database From User Input',
'Update ASM Database from CAMS Download Data',
'Update from Previous Schedule','*Schedule Print Menu*',
'Dock Forecast With Time Change Items',
'Load/Initiate Schedule Period',
'Dock Scheduling Module ASM #84A',
'Modify Schedule Screen ASM # 84',
'Update Sortie Information Screen ASM #84',
'*Display/Print Schedules ASM #85*',
'Display/Print Daily Flying Schedule Screen ASM # 85A',
'Schedule Grid Format Screen ASM #85A',
'Display/Print Flying Schedule TAC Form 297 Screen ASM
#85A','Schedule Print Menu Screen ASM #85A',
'Display/Print Abbreviated Daily Flying Schedule',
'Schedule Print Menu Screen ASM #85D',
'*Utility Programs Menu Screen ASM #86*',
'Automated Scheduling Module Aircraft Data Menu Screen ASM
#87','Automated Scheduling Module--Aircraft Update Screen
ASM #86','Review/Change Scheduling Parameters Screen ASM #
88','Upload Flying Maintenance Schedule to CAMS',
'Related Processing','Data Backup',
'Recovery from Errors and Malfunctions','Messages'].
```

```
ask (' Choose your selection now. There is also a "VIEW ALL"
function in this section.
```

```
Choosing #fbrown Quit#d takes you back to the previous menu.#d',
look,?contents).
```

```
if ?look <> 'Quit'
or '*Utility Programs Menu Screen ASM #86*'
or '*Display/Print Schedules ASM #85*'
or '*Schedule Print Menu*'
or '*MDS Selections Menu, Screen ASM #81*'
or '*Main Menu, Screen ASM #82*'
or '*Update ASM Database*'
then do (?look)
and do ('5A. Section Four, Processing Reference Guide')
else do ('select method').
end. (* 5A. Processing Reference Guide *)
```

```
topic 'Purpose of the End User Manual'.
say (
    #flightcyan PURPOSE OF THE END USER MANUAL.#d
    #fyellow
    The objective of the End User Manual for the Automated
    Scheduling Module (ASM), DSD G054/FS is to provide the users,
    non-ADP personnel, with the information necessary to use the
    system effectively, including operation of the Z-248
    #mmicrocomputer#m.').
```

```
end. (* Purpose of the End User Manual *)
```

```
topic 'Purpose of the System'.
```

```
say (
    #flightcyan PURPOSE OF THE SYSTEM.#d
    #fyellow
    The purpose of the ASM is to provide the functional user
    with an automated system that will generate a flying and
    maintenance schedule on a monthly, weekly, or daily basis.
    ASM will significantly speed up the scheduling process allowing
    the user more time to check scheduling options and ensure
    that a more effective or realistic schedule is produced.
    ASM allows the user to build the schedule in a separate
    environment from the base level computer so there is
    virtually no interference from other users or mainframe
    down time. Once the schedule is produced and the user has
    verified its accuracy, the schedule can be included in the
    monthly, weekly or daily maintenance plan.').
END. (* Purpose of the System *)
```

```
topic 'References'.
```

```
say (
    #flightcyan REFERENCES.#d
    #fyellow OS-61-8 / OS-63-31
    Manual '). MS-DOS Reference
end. (* References *)
```

topic 'Terms and Abbreviations'.

```
say ('#flightcyan TERMS AND ABBREVIATIONS.#d
#fyellow
The following is a list of terms and abbreviations used within
the Automated Scheduling Module.

ASCII      American Standard Code for Information Interchange.
ASM        Automated Scheduling Module.
CAMS       Core Automated Maintenance System.
COBOL      Common Business Oriented Language.
CRT        Cathode Ray Tube.
DOWNLOAD   Process of transferring information pertinent to ASM
           down from the Unisys 1100/60 to the designated
           computer.
K          One Kilobyte of RAM is 1,024 characters of data.
MEGABYTE   A unit of measure of computer disk space capable of
           storing one million characters of data.
MS-DOS     Microsoft Disk Operating System.
RAM        Random Access Memory.
TCI        #MTTime Change Items.#M
TCTO       Time Compliance Technical Order.
Z-248      Zenith Data Systems Z-248/IBM PC/AT compatibles.').
end.

topic 'Time Change Items.'.
window ('',red,lightgray,green,5,8,78,9).
say (' The primary objective of the time change replacement program
      is to achieve maximum utilization of accessories consistent
      with the economic operation of weapon systems, support systems
      and equipment without jeopardizing flight or operational safety.
      Time change replacement requirements will be prescribed only for
      those items that have a measured life expectancy and that dis-
      play an age related failure pattern; for an example, a failure
      pattern that rises sharply at some given operation time or age
      of an item.').
close_window ().

topic 'Sensitivity'.

say (
      "#flightcyan SENSITIVITY.#d
#fyellow
The automated Scheduling Module does not process any classified
or Privacy Act data. The designated users will have complete
control of both ASM and the #mmicrocomputer#m and will be
primarily responsible for access to and security of ASM.
Physical security of both the microcomputer and the software
will be the responsibility of the user. Database backup
capability will be provided, but it is the users responsibility
to accomplish this on a regular basis.').
end. (* Sensitivity *)
```

```
topic '6. Return to ASM'.
chain ('gone.bat').
end. (* Return to ASM *)

topic 'VIEW ALL-1'.
do ('Purpose of the End User Manual').
do ('Purpose of the System').
do ('References').
do ('Terms and Abbreviations').
do ('Sensitivity').
end.

topic 'VIEW ALL-2'.
do ('Applications Summary').
do ('Performance').
do ('Controls').
do ('Hardware Required').
do ('Software Required').
do ('Contingencies and Alternate Modes of Operation').
do ('Assistance and Problem Reporting').
end.

topic 'VIEW ALL-3'.
do ('First-Time Use of the System').
do ('Equipment Familiarization').
do ('Access Control').
do ('Installation and Setup').
do ('Hard Disk Partitioning').
do ('ASM SubDirectories').
do ('Loading ASM System Software').
do ('Initializing the ASM Database').
do ('Initiating a Session').
do ('Stopping and Suspending Work').
end.

topic 'VIEW ALL-4'.
do ('Capabilities').
do ('Conventions').
do ('Processing Procedures').
do ('Automated Scheduling Update, NFS2V0, CAMS Screen #509').
do ('*MDS Selections Menu, Screen ASM #81*').
do ('*Main Menu, Screen ASM #82*').
do ('*Update ASM Database*').
do ('Initialize ASM Database from CAMS Download Data').
do ('Initialize the ASM Database From User Input').
do ('Update ASM Database from CAMS Download Data').
do ('Update from Previous Schedule').
do ('*Schedule Print Menu*').
do ('Dock Forecast With Time Change Items').
do ('Load/Initiate Schedule Period').
do ('Dock Scheduling Module ASM #84A').
do ('Modify Schedule Screen ASM # 84').
```

```
do ('Update Sortie Information Screen ASM #84').
do ('*Display/Print Schedules ASM #85*').
do ('Display/Print Daily Flying Schedule Screen ASM # 85A').
do ('Schedule Grid Format Screen ASM #85A').
do ('Display/Print Flying Schedule TAC Form 297 Screen ASM #85A').
do ('Schedule Print Menu Screen ASM #85A').
do ('Display/Print Abbreviated Daily Flying Schedule').
do ('Schedule Print Menu Screen ASM #85D').
do ('*Utility Programs Menu Screen ASM #86*').
do ('Automated Scheduling Module Aircraft Data Menu Screen ASM #87').
do ('Automated Scheduling Module--Aircraft Update Screen ASM #86').
do ('Review/Change Scheduling Parameters Screen ASM # 88').
do ('Upload Flying Maintenance Schedule to CAMS').
do ('Related Processing').
do ('Data Backup').
do ('Recovery from Errors and Malfunctions').
do ('Messages').
end.
```

topic 'Table of Contents - From Start to Finish'.  
say '

#flightcyan DEPARTMENT OF THE AIR FORCE  
Headquarters US Air Force  
Washington DC 20330-50003

AF MANUAL 66-279  
Volume XXI  
1 December 1990

DISTRIBUTION LIMITED TO DOD,  
REFER OTHER REQUESTS TO THE STANDARD COMMUNICATIONS-COMPUTER  
SYSTEMS MANAGER

#### Equipment Maintenance

CORE AUTOMATED MAINTENANCE SYSTEM (CAMS) DSD:G054/FS

AUTOMATED SCHEDULING MODULE (ASM)

END USER MANUAL

This volume contains detailed information describing the operation of the Automated Scheduling Module on the Z-248. It applies to all activities processing the Automated Scheduling Module (ASM).

This manual is not currently affected by the Privacy Act of 1974. In the event that Privacy Act information is incorporated within the system at a later date, all data subject to the Privacy Act and all applicable output documents will be protected.

The inclusion of names of any specific commercial product, commodity, or service in this publication is for information purposes only and does not imply endorsement by the Air Force.

#### TABLE OF CONTENTS

PAGE	
SECTION 1.	GENERAL
1.1	Purpose of the End User Manual . . . . . 1-1
1.2	Purpose of the System . . . . . 1-1
1.3	References . . . . . 1-1
1.4	Terms and Abbreviations . . . . . 1-1
1.5	Sensitivity . . . . . 1-1
SECTION 2.	SYSTEM SUMMARY
2.1	Overview . . . . . 2-1
2.1.1	Application Summary . . . . . 2-1
2.1.2	Performance . . . . . 2-1
2.1.3	Controls . . . . . 2-1
2.2	System Environment . . . . . 2-2
2.2.1	Hardware Required . . . . . 2-2
2.2.2	Software Required . . . . . 2-2
2.3	Contingen. and Alternate Modes of Operation 2-2
2.4	Assistance and Problem Reporting . . . . . 2-2
SECTION 3.	ACCESS TO THE SYSTEM
3.1	First-Time Use of the System . . . . . 3-1
3.1.1	Equipment Familiarization . . . . . 3-1
3.1.2	Access Control . . . . . 3-1
3.1.3	Installation and Setup . . . . . 3-1
3.1.3.1	Hard Disk Partitioning . . . . . 3-2
3.1.3.2	ASM Subdirectories . . . . . 3-3
3.1.3.4	Loading ASM System Software . . . . . 3-3
3.2	Initializing the ASM Database . . . . . 3-3
3.2	Initiating a Session . . . . . 3-4
	Stopping and Suspending Work . . . . . 3-4
SECTION 4.	PROCESSING REFERENCE GUIDE
4.1	Capabilities . . . . . 4-1
4.2	Conventions . . . . . 4-1
4.3	Processing Procedures . . . . . 4-1
4.3.1	Automated Scheduling Update, NFS2V0, CAMS Screen # 509) . . . . . 4-2

4.3.2	Mission Design Series Selection Menu (ASM Screen # 81) . . . . .	4-2
4.3.3	Main. Menu, Screen ASM # 82. . . . .	4-3
4.3.3.1	Update ASM Database . . . . .	4-3
4.3.3.1.1	Initialize ASM Database from CAMS	
4.3.3.1.2	Download Data . . . . .	4-4
4.3.3.1.3	Initialize the ASM Database from User Input . . . . .	4-8
4.3.3.1.4	Update ASM Database from CAMS	
4.3.3.2	Download Data . . . . .	4-11
4.3.3.2.1	Update from Previous Schedule. . .	4-11
4.3.3.2.2	Schedule Print Menu . . . . .	4-13
4.3.3.2.3	Dock Fore. w/ Time Change Items. .	4-14
4.3.3.2.5	Load/Initiate Schedule Period . .	4-15
4.3.3.3	Dock Scheduling Module ASM # 84A .	4-27
4.3.3.3.1	Modify Schedule Screen ASM # 84 .	4-32
4.3.3.3.2	Update Sortie Info. Screen ASM # 84	4-33
4.3.3.3.3	Display/Print Schedule ASM # 85 .	4-34
4.3.3.3.4	Schedule Print Menu ASM # 85A .	4-35
4.3.3.3.5	Display/Print Daily Flying Schedule	
4.3.3.3.6	Screen ASM # 85A . . . . .	4-36
4.3.3.4	Display/Print Daily Flying Schedule Grid	
4.3.3.4.1	Format Screen ASM # 85A. . . . .	4-37
4.3.3.4.2	Display/Print Daily Flying schedule TAC Form	
4.3.3.4.3	297 Screen ASM # 85A . . . . .	4-38
4.3.3.4.4	Schedule Print Menu Screen ASM # 85A	
4.4	Display/	
4.5	Print Abb. Daily Flying Schedule	4-39
4.6	Schedule Print Menu Screen ASM # 85D	
4.7	Display/	
	Print Daily Maintenance Schedule	4-40
	Utility Programs Menu Screen ASM # 86	4-42
	Automated Scheduling Module Aircraft Data	
	Menu Screen ASM # 87 . . . . .	4-43
	Automated Scheduling Module--Aircraft Update	
	Screen ASM # 86. . . . .	4-52
	Review/Change Scheduling Parameters	
	Screen ASM # 88. . . . .	4-56
	Upload Flying Maint. Schedule to CAM	4-67
	Related Processing. . . . .	4-71
	Data Backup . . . . .	4-71
	Recovery from Errors and Malf. . . . .	4-71
	Messages. . . . .	4-71').

end.

```
topic 'Applications Summary'.
say (' #flightcyan APPLICATION SUMMARY.#d
#fyellow
      ASM is a tool for plans, scheduling and documentation. It is
      a menu driven system written in COBOL. Automated Scheduling
      is designed to be #muser friendly#m, not requiring formal
      training. #flightgreen

      a. The system has four basic subsystems,
      update/initialization,
      schedule generation, schedule printing, and utilities.#d
#fyellow
      (1) The update/initialization subsystem provides the
          capability to initialize and update the database on the
          #mmicrocomputer#m in four different methods.

      (2) The schedule generation subsystem performs all of the
          functions related to producing an aircraft utilization
          and maintenance schedule. This includes entering oper-
          ational requirements, generating the schedule,
          modifying the schedule, and printing the schedule for
          review.

      - MORE TO FOLLOW -

      (3) The schedule printing subsystem allows the user to
          print facsimiles of standard Air Force forms such as
          the AF Form 2401, AF Form 2402, and AF Form 2436.

      (4) The utilities subsystem provides a means of updating
          the scheduling rules input during the initialization
          process. This system also allows for the update of the
          aircraft database. Output products are also available
          from this subsystem that are generic to plans,
          scheduling and documentation.

      b. Automated Scheduling requires connectivity to the Unisys
          1100/60 mainframe, either through a direct connect modem or
          terminal multiplexer (TMUX).

      c. The only interface presently required is the UTS-40
          emulator, Unisys Compatibility by CHI.

      d. Inputs to Automated Scheduling are made from the keyboard.
          Specific data requirements are governed by MAJCOM directives
          and individual users needs.').
end.
```

```
topic 'PERFORMANCE'.
say ('#flightcyan PERFORMANCE.#d
#fyellow
Automated Schedulings overall performance
will vary depending on the size and complexity of the
aircraft database. The interface performance with the
Unisys 1100/60 will depend on its traffic.').
end.
```

```
topic 'CONTROLS'.
say ('#flightcyan CONTROLS.#d
#fyellow
This system is totally controlled by the user; all
inputs, outputs and processes are governed by user inputs.
If the aircraft database or system programs are inadvertently
erased or corrupted, they may cause system hang-ups.
The System program integrity must be maintained.
The system user is responsible to ensure that no program
is modified or deleted from the system. Backup and recovery
of the aircraft database is discussed in paragraphs:
4.5 and 4.6. Reinitializing the system following a
#mmicrocomputer#m failure would require reinstalling the
ASM software (paragraph 3.1.3) and restoring the most
current database backup.').
end.
```

```
topic 'HARDWARE REQUIRED'.
say ('#flightcyan HARDWARE REQUIRED.#d
#fyellow
The following #mmicrocomputer#m hardware is required to run ASM:
a. Zenith Z-248 or other IBM PC/XT or AT compatible
microcomputer.
b. 640K RAM or more memory.
c. 20 Megabyte hard disk or larger.
d. 1 - 360K floppy disk drive.
e. Dot matrix printer (with graphics support and letter
quality modes recommended).
f. TMUX or direct connect modem and connecting cables.
```

```
NOTE: If a microcomputer other than a Z-248-62 is used, it must
meet or exceed the specifications of the Z-248-62 with respect
to CPU processor, internal memory, and hard disk size/speed.').
end.
```

```
topic 'SOFTWARE REQUIRED'.
say ('#flightcyan SOFTWARE REQUIRED.#d
#fyellow
The software required to support the advanced features
of Automated Scheduling is MS-DOS version 3.0 or later
and Unisys Emulator by CHI, version 6.12b or later.
The ASM programs are written in Microsoft COBOL version
3.0 and are identified by the file extension ".EXE".
ASM will also use MS-DOS batch files identified by the
file extension ".BAT". These programs are listed by
program ID and title in attachment 1.').
end.

topic 'CONTINGENCIES AND ALTERNATE MODES OF OPERATION'.
say ('#flightcyan CONTINGENCIES AND ALTERNATE MODES OF OPERATION.#d
#fyellow
Automated Scheduling is designed to operate on the
Z-248 using data downloaded from the Unisys 1100/60.
When access to the mainframe is denied, two alternate
methods of database update are designed into the system.
The system provides full capabilities to satisfy
peacetime scheduling requirements as well as those of
increased alert and wartime.').
end.

topic 'ASSISTANCE AND PROBLEM REPORTING'.
say ('#flightcyan ASSISTANCE AND PROBLEM REPORTING.#d #fyellow
SSC/SSFA, Field Assistance Division is the primary
agency for problem solving and assistance. Difficulty
reports will be reported in the same manner as those for
the Core Automated Maintenance System on the Unisys 1100/60.
Refer to AFM 66-279, volume I, paragraph 1.5a and process all
problems through the unit database manager.').
end.

topic 'First-Time Use of the System'.
say ('#flightcyan FIRST-TIME USE OF THE SYSTEM.#d #fyellow
In organizations where the Automated Scheduling Module (ASM)
has not been used, the user must first complete the
implementation procedures described in paragraph 3.1.3 below.
The user must also be familiar with the #mmicrocomputer#m being
used for Automated Scheduling.').
end.
```

```
topic 'Equipment Familiarization'.
say ('#flightcyan EQUIPMENT FAMILIARIZATION.#d
#fyellow Specific computer familiarization cannot be provided for
all of the possible computers that may be used for Automated
Scheduling. The most beneficial method for the user to become
familiar with the equipment is to utilize the specific owners
manual that came with the #mmicrocomputer#m that will be used
for ASM. Most systems also have a tutorial or demonstration
disk packaged with the microcomputer that will aid the user.
Equipment familiarization is a user responsibility that must
be accomplished prior to implementing ASM.').
end.
```

```
topic 'Access Control'.
say ('#flightcyan ACCESS CONTROL.#d
#fyellow The user has primary control over who will have access to and
use ASM. Due to the location of the #mmicrocomputer#m and
related equipment, physical security is also a responsibility
of the user. As Automated Scheduling does not process any data
that is classified nor affected by the Privacy Act there are no
controls required for them. Output products are provided for
the sole use of the user and are not interfaced with other
systems; therefore, no special markings are required.').
end.
```

```
topic 'Installation and Setup'.
say ('#flightcyan INSTALLATION AND SETUP.#d
#fyellow ASM has been developed for release with all software and
installation programs. Specific installation procedures for
ASM are found in paragraphs 3.1.3.1 through 3.1.3.3. The
following steps will prepare the #mmicrocomputer#m to use ASM:
```

a. It is recommended that the command "PROMPT \$P\$G" be added to the "AUTOEXEC.BAT" file. The use of this command will cause the MS-DOS prompt to display the subdirectory currently in use (C:\ASM). Additionally, the "PATH" and the "CONFIG.SYS" file require modification. Refer to your MS-DOS manual supplied with the microcomputer, the procedures should be as follows:

- (1) At the C:\ prompt enter EDLIN AUTOEXEC.BAT, (see sample input below). An "\*" should appear on the next line.
  - (a) Input an "L" and the contents of the AUTOEXEC.BAT file should appear.

- (b) To modify the contents of a single line, input the line number only and that line number will appear prefilled with the second blank line for you to type in the changes; pressing the enter key will process your changes.
- (c) To add a line or lines, determine where you want to add the line and enter the line number followed by "i" and that line number will appear blank for you to type in the inserted line(s). When the inserted lines are completed, hold the "CTRL" key down and press "Z" to terminate the insert function.
- (d) Verify that your AUTOEXEC.BAT file contains the two lines indicated in the sample output below by inputting "L" again behind the "\*". These are the minimum required lines and if other commands are present they should not affect the operation of ASM.
- (e) To save the changes and exit "EDLIN", enter "E" and press enter, the MS-DOS prompt (C:\>) should reappear.

SAMPLE INPUT: C:\>EDLIN AUTOEXEC.BAT (enter)

SAMPLE OUTPUT: End of input file  
\*L (enter)  
1: \*PROMPT \$P\$G  
2: PATH=C:\;DOS;\ASM

NOTE: If these files do not exist on your hard disk, EDLIN will create them automatically, the only difference will be the first response after the input will be "New File".

- (2) The "CONFIG.SYS" file must also be modified using the same procedures as those used to modify the "AUTOEXEC.BAT" file (see sample input/output below).

SAMPLE INPUT: C:\>EDLIN CONFIG.SYS (enter)

SAMPLE OUTPUT:

End of input file  
\*L (enter)  
1: \*BUFFERS=16  
2: \*FILES=100  
3: DEVICE=ANSI.SYS

- (a) Ensure that both the "CONFIG.SYS" and "ANSI.SYS" file are resident on the root directory. If the "CONFIG.SYS" file was created using EDLIN from the root

directory, it will already be there. The "ANSI.SYS" file will normally be found in the directory containing the "DOS" commands. These files are normally found in either the "C:\BIN" or "C:\DOS" subdirectory.

- (b) When these files have been located, use the copy command to copy these files to the root directory (C:\>).

SAMPLE INPUT:

```
COPY ANSI.SYS C:\ (enter)
```

b. After both the AUTOEXEC.BAT and CONFIG.SYS files are modified, your #microcomputer# must be rebooted.

Simultaneously press the "CTRL", "ALT" and "DEL" keys and wait for the MS-DOS prompt (C:\>) to reappear before proceeding.').

end.

topic 'Hard Disk Partitioning'.

say ('

```
#flightcyan HARD DISK PARTITIONING.#d
```

#fyellow

Hard disk partitioning is not required for ASM. ASM will operate on a hard disk with one or more partitions even when ASM is being used to schedule MDSs. However, ASM must be installed on the same hard disk partition that contains the terminal emulation software for interface with the Unisys 1100/60. Consult the appropriate MS-DOS manual for hard disk setup instructions.').

end.

topic 'ASM SubDirectories'.

say ('

```
#flightcyan ASM SUBDIRECTORIES.#d
```

#fyellow

When using ASM to schedule multiple MDSs, the database for each MDS is contained in a separate subdirectory. These will be created during the first steps of initializing the system. More may be added at any time from the first ASM menu screen.

These files should never be erased or deleted.').

end.

topic 'Loading ASM System Software'.

say ('

```
#flightcyan    LOADING ASM SYSTEM SOFTWARE.#d
```

#fyellow

At this time, you should verify that you have received all the necessary diskettes as listed below. If you have everything listed, place diskette # 1 in the floppy drive. At the MS-DOS prompt (A:\), input "INSTALL C:\\" and press enter.

```
DISK #  LABEL  
1      Disk 1 of 6  Automated Scheduling Module (ASM)  
2      Disk 2 of 6  Automated Scheduling Module (ASM)  
3      Disk 3 of 6  
4      Disk 4 of 6  
5      Disk 5 of 6  
6      Disk 6 of 6').
```

end.

```
topic 'Initializing the ASM Database'.  
say ('  
#flightcyan INITIALIZING THE ASM DATABASE.#d  
#fyellow
```

This is a two-step process. Step one is the creation and downloading of the data file from the CAMS system. Step two is the initialization of the ASM database within the #mmicrocomputer#m as described in paragraph 4.3.3.1.2.

a. Using the UTS-40 emulator (CHI), sign on to CAMS in the normal method. After you have properly signed on, input # 509. Completion of this screen will allow you to process the download program. The processing time will vary depending on the workload on the mainframe computer and the number and type of aircraft being scheduled. To periodically check to see if program NFS2V0 has finished processing, input "BSIXI" and check the status of the program.

b. The following steps must be performed to download the file from the mainframe (CAMS) to the microcomputer.

- (1) Sign on to the system in the DEMAND mode.
- (2) Enter @CTS,IN and press enter/xmit.
- (3) Enter the file qualifier, see example below.

SAMPLE INPUT: OLD 2FSX2V001430\*AFSTAFUNDD10

NOTE: The information listed below will aid in formatting the input required. You may have to obtain some of the information from the unit database manager.

COLUMN	DATA
1-3	OLD
4	Blank
5	System gang number (normally 1 unless the system is split into gangs; contact your database manager if you are unsure)
6-7	FS (System Code)
8	X (Unit ID)
9-11	2V0 (Program ID).
12-16	Background print file number (from BSIXI output)
17-20	*AFS

COLUMN	DATA
21-23	First three positions of owning workcenter mnemonic that were input on screen 509.
24-29	UNDD10

- (4) Enter "P space +20" which will bring up the first 20 lines of the data retrieved from the input made on CAMS screen 509. To be sure you have the correct file, check the aircraft ID numbers.
  - (5) To start the download, press the "9/PgUp" key and enter MRECORD space (FILENAME.EXT) then press the enter key. Where FILENAME can be any name for the data file being downloaded, the EXT can also be any extension. Example: KC135A.DAT
  - (6) Enter "P space A space N" and press the enter key. The screen should be scrolling data that is being received by the #mmicrocomputer#m. This process will take a few minutes. The total time will depend on the number and complexity of the aircraft being scheduled.
  - (7) When the END-OF-FILE appears, press the "9/PgUp" key and enter CLOSE then press the enter key.
  - (8) At this time sign off of Demand mode in the normal manner, then, press the 9/PgUp key and enter "DOS" to get back to MS-DOS. When the MS-DOS prompt (C:\>) appears, enter CD\ASM and press enter. You are prepared to continue with the initialization or update of the ASM database.
- c. When the data has been downloaded into the microcomputer, you are ready to start initializing the database within the microcomputer. Completing paragraphs 4.3.2 through 4.3.3.1.2 will complete the initialization process.').

end.

```
topic 'Initiating A Session'.
say (
      #flightcyan INITIATING A SESSION.#d
#fyellow
      To begin ASM and initialize the system, type the command "ASM"
      and press ENTER. The ASM MDS Selection Menu will be displayed
      on the CRT. Pressing the escape key will terminate the
      current ASM session.

      NOTE: All ASM entries must be in capital letters; press your
            "Caps Lock" key and ensure it remains on.

      WARNING: Ensure CHI is not operating because this will cause
               system lock-up due to memory consumption. ASM must be
               operated through MS DOS to ensure proper operation.').
end.

topic 'Stopping And Suspending Work'.
say (
      #flightcyan STOPPING AND SUSPENDING WORK.#d
#fyellow
      To end the ASM session you must press the "ESC" key while the
      MDS Selection Menu is displayed. Work is suspended anytime any
      ASM menu screen is displayed. For emergencies, the CONTROL KEY
      and the "C" key pressed simultaneously will abort the system.
      Again, this is for emergencies and should never be done when
      the disk access lights are on or flashing on and off.').
end.

topic 'Capabilities'.
say (
      #flightcyan CAPABILITIES.#d
#fyellow
      Once initialized, ASM will produce daily, weekly, and monthly
      maintenance and operations schedules for inclusion in the unit
      maintenance plans. Management products such as the Time
      Distribution Index (TDI) are available under the utilities
      program menu for evaluating the schedules produced by ASM.
      Since the schedules are produced from fixed parameters, it
      will be necessary to ensure these parameters are established
      to make optimum use of maintenance resources. Maintenance
      actions maybe added, changed or deleted from the schedule
      manually.').
end.
```

```
topic 'Conventions'.
say ('
  #flightcyan CONVENTIONS.#d
#fyellow
  ASM is designed for use with Zenith Z-248-62 #mmmicrocomputer#m
  and a color monitor.
```

- a. To speed up processing, the main menu and some other screens do not require using the enter key in combination with the input. If an incorrect option is entered, the ESC key will return the user to the main menu. Use the return key or the down arrow key to move the cursor to the next field on the screen. The up arrow will return you to the previous field for corrections.
- b. As you tab through the screen, help instructions for each field will appear at the bottom of the screen. These help fields describe input requirements and any special processing instructions. These fields tell you how to proceed through ASM.
- c. Normal screen colors used are cyan background with yellow foreground letters. All error messages and warning messages will be displayed with a red background with a white foreground. Information that is of particular interest to the user is displayed in other highlight colors while the spaces provided for user inputs will be displayed in a dark blue background color with yellow foreground.').

end.

```
topic 'Processing Procedures'.
say (' #flightcyan PROCESSING PROCEDURES.#d
#fyellow
  ASM has four modules; the update or initialization module, the schedule generation module, schedule print module, and the utility module. The following paragraphs will describe the processing for each of the options on the ASM menus.
```

NOTE: The help screens for each field explain how to enter data or process the parent screen. Only the parent screens are described in this volume.

- a. Initializing module inputs are discussed in paragraph 4.3.3.1.
- b. Generating a flying and maintance schedule inputs are discussed in paragraph 4.3.3.2.
- c. Printing the various schedule inputs is discussed in paragraph 4.3.3.3.

- d. Updating scheduling parameters is subdivided into three categories/menus:
- (1) The display/print aircraft data options provide scheduling output products such as TDIs, aircraft standings, and Time Compliance Technical Order (TCTO) data. Options six and seven provide output products as well as the capability to update the data displayed. These options are found in paragraph 4.3.3.4.1.
  - (2) The add/delete aircraft option is described in paragraph 4.3.3.4.2.
  - (3) The review/change scheduling parameters option allows updating of the rules and parameters input during the initialization process. These rules may require changing to accommodate changes in unit scheduling procedures. These capabilities are discussed in detail in paragraph 4.3.3.4.3.').
- end.
- ```

topic 'Automated Scheduling Update, NFS2V0, CAMS Screen #509'.
say (
      #flightcyan AUTOMATED SCHEDULING UPDATE, NFS2V0, CAMS SCREEN #
      509.#d
#fyellow This program creates a disk file on the Unisys 1100/60 to be
      downloaded to the #mmicrocomputer#m for processing into the ASM
      database.').
end.

topic '**MDS Selections Menu, Screen ASM #81*'.
say (
      #flightcyan MISSION DESIGN SERIES SELECTION MENU, SCREEN #mASM
      81#m.#d
#fyellow This screen has two functions. When it is processed,
      it defaults to screen #mASM 83#m if the database has not
      yet been initialized. Processing of an initialized
      database starts with screen #mASM 82#m.

```

- a. First, it sets up subdirectories in MS-DOS to separate the different MDS databases being scheduled. To create a subdirectory, press the F2 key and enter the MDS or MDSS that should be contained in that database. In the screen ASM # 81 below both F-15A and F-15B aircraft will be scheduled using the same rules and parameters. The schedules produced will have both MDSSs. However, when specific mission requirements are required for F-15B model aircraft, they may be scheduled using either

configuration codes or mission codes for those aircraft.  
NOTE: The MDS entry format is the same as that used in CAMS,  
using the first eight positions only.

b. The second function is to operate the ASM system and use  
the appropriate subdirectory selected by the user. Exiting  
ASM is also done from this screen to ensure file integrity  
is maintained, by pressing the "ESC" key.').

end.

```
topic '*Main Menu, Screen ASM #82*'.
say ('#flightcyan MAIN MENU, SCREEN #mASM 82#m.#d
#fyellow Enter an option and the system will auto-process.
Press the "ESC" key to return to this screen.').
end.
```

```
topic '*Update ASM Database*'.
say ('#flightcyan UPDATE ASM DATABASE.#d
#fyellow Screen #mASM 83#m allows the update of the ASM database.
This screen is retrieved through the Main Menu, screen
#mASM 82#m, option 1. It has the following options.
```

- a. Options 1 and 2 are only accomplished once unless the  
#mmicrocomputer#m hard disk has been inadvertently erased.
- b. Option 3 updates the database from the data downloaded  
from CAMS.
- c. Option 4 updates the database using schedules  
generated within ASM. This option is provided to allow  
the user to update the database when CAMS is  
off-line or no download data retrieval is available.').

end.

```
topic 'Initialize ASM Database From CAMS Download Data'.
say ('#flightcyan INITIALIZE ASM DATABASE FROM CAMS DOWNLOAD DATA.#d
#fyellow Screen ASM # 83A is retrieved through the Update/Initialize
Menu, screen #mASM 83#m, option 1. Screen ASM # 83A allows
the processing of the download from CAMS and building of
the ASM database on the #mmicrocomputer#m. An input example
of the database to be created is provided. (NOTE: Refer to
the MS-DOS manual under the command PATH for more help on
file names.) Initializing the ASM database is a lengthy
process and must not be interrupted until the overlay message
screen "PLEASE STAND BY - PROCESSING RECORDS" disappears.
The records created are the Aircraft, Time Change,
Inspection, Time Compliance Technical Order, and Job Standard
Records. After the records are downloaded, they must be
initialized.
```

a. Screen ASM # 13 appears when the initialization of the aircraft data records is complete. The inspection, time change, and inspection dock parameters are initialized at this time. Enter the Inspection Type to start processing. Inspection Type "I" retrieves screen ASM # 14 for Inspection/Time Change. Inspection Type "D" retrieves screen ASM # 15 for Dock or Phase Inspection. The processing sequence for Dock or Phase Inspection is similar to Inspection/Time Change processing except the initial screen is ASM # 15. Inspection type "N" skips inspections that are not required to be tracked by ASM. To modify an inspection, enter "M" in the option field. To return to a previous inspection, enter "P" in the option field.

(1) Inspection Type "I" retrieves screen ASM # 14. This screen allows data to be entered for a specific JST. For the first JST, ASM returns the user to screen ASM # 13 to fill the parameters for another JST. After the second JST has been processed, ASM defaults to screen ASM # 93.

(a) Action Code Compatibility, screen ASM # 93, is used to schedule actions that may be worked at the same time. If the action is compatible, enter an "X" and press F10. If the actions are not compatible, leave the field blank and arrow down to the next action code.

(b) After screen ASM # 93 is processed, ASM defaults to Inspection Set-Up, screen ASM # 13, in order to process the next JST. This processing sequence repeats until all Inspection/Time Change codes have been entered.

(2) Inspection Type - "D". Retrieves screen ASM # 15. This screen is used to enter the parameters for dock inspections. After each dock input has been entered, ASM defaults to screen ASM # 13. When all Inspection/Time Change codes have been entered, press F2 to retrieve screen ASM # 16.

(a) Screen ASM # 16 allows entering of the parameters for the unit inspection dock(s) and the rules that govern the scheduling of aircraft for the dock(s).

(b) After Dock or Phase Inspections have been entered, process screen ASM # 92 to define the scheduling rules. Press ESC to process screen ASM # 92 and retrieve screen ASM # 90.

(c) Screen ASM # 90 will display the relative priority of recurring actions that ASM has computed and allow the user to modify that priority. The relative priority is the sequence the user would schedule actions in provided they all had the exact same due date/time. ASM has computed the relative priority by sorting the inputs, first, by the length of time action could be deferred, then by the length of time an action could be accomplished early, both in ascending order. Then, they are sorted by the length in days that the action requires to complete in a descending order. Time changes will have a higher priority than inspections. Press F10 to retrieve screen ASM # 96.

(d) Use screen ASM # 96 to process TCTO parameters. After this screen is processed, screen ASM # 93 is retrieved.

(e) Process screen ASM # 93. Screen #mASM 83#m will then appear. Initialization is now complete.

(3) Those inspections that are event type or do not have a fixed recurring frequency such as Programmed Depot Maintenance and hard landings should not be tracked in ASM. Programmed Depot Maintenance should be scheduled using the Special Events program (screen ASM # 64) which will automatically operate when schedule requirements are entered.').

end.

topic 'Initialize the ASM Database From User Input'.

```
say (' #flightcyan INITIALIZE THE ASM DATABASE FROM USER INPUT.#d
#fyellow The difference between using a database downloaded from
CAMS and creating an ASM database from user input is a
series of screen which allow input of all aircraft and
inspection records that will be tracked. The manual
process requires the user to have data for the aircraft
being scheduled similar to the CAMS Planning and Inspection
Requirements (PRA), Current Operating Time (COT) and the
Workable TCTO Report (WTR). (NOTE: It is recommended
that this option not be used unless CAMS is unavailable.)
From screen #mASM 83#m, select option 2 to retrieve an
overlay help screen ASM # 83A which identifies the
information needed to manually create an ASM database.
Press return to retrieve screen ASM # 42 to begin entering
data.
```

b. Screens ASM # 42, # 42A, and # 42B provide the capability to input the aircraft current operating time as well as inspection, time change and job standard records. Follow the directions in the help screens to process the parent screens and create an ASM database from user input. The series of screens are repeated until all Inspection/Time Change records are created.

NOTE: Type update field should be either "D" for date due or "C" for date complied with.

c. After all Inspection/Time Change records are created and screen ASM # 42 reappears, press F2 to retrieve screen ASM # 45 to enter TCTO data. Press F10 to save this screen and load the TCTO records on the database.

d. When the process of creating database has been completed, press F2 to screen ASM # 13 to initialize the database. Process the database as described in paragraph 4.3.3.1.1.').

end.

topic 'Update ASM Database from CAMS Download Data'.  
say ('

#flightcyan UPDATE ASM DATABASE FROM CAMS DOWNLOAD DATA.#d  
#fyellow Option 3 of screen #mASM 83#m is used to process the #mupdate download#m into the ASM database in the same manner described in paragraph 4.3.3.1.1.').

end.

topic 'update download'.

window ('',white,blue,yellow,5,8,78,10).

say (' The update download is processed in the same manner as the Initialization Download except the user needs to be aware of any changes in aircraft status since the most recent download. For example, if you had an aircraft in the ASM database, and the aircraft was transferred in CAMS, you must manually go into ASM and delete the aircraft ID. Also, prior to processing the download, the user must verify that all TCIs and TCTOs have been updated in CAMS.').

close\_window ().

end.

topic 'Update from Previous Schedule'.

say (' #flightcyan UPDATE FROM PREVIOUS SCHEDULE.#d

#fyellow Option 4 of screen #mASM 83#m is used to review ASM schedules and provide inputs relative to the update routines. The ASM database is updated based on the user indicating whether scheduled actions were completed as scheduled, then ASM calculates new due times for inspections and updates aircraft operating times from the updated flying schedules.

a. This allows the user to process previously generated schedules and update the database manually. Screens will be processed in the following sequence.

- (1) Screen ASM # 10 which allows modification to the sorties/missions scheduled based on what actually happened and update the air-frame hours.
- (2) Screen ASM # 12 which allows update to the inspection and time change database records based on actual accomplishment of those scheduled events.
- (3) Screen ASM # 11 which updates TCTO records based on actual accomplishment. Updates only appear in the ASM database.
- (4) Screen ASM # 64 which allows updates to any special events loaded.').

end.

topic '\*Schedule Print Menu'.

```
say (' #flightcyan SCHEULE PRINT MENU, #mASM 84#m.#d
      #fyellow Screen #mASM 82#m, option 2 retrieves the Schedule
      Print Menu, screen ASM # 84. The Schedule Print Menu has
      four options for entering the flying schedule requirements
      under option 2 of this menu. All of the options require the
      user to validate the MDS scheduling rules prior to processing
      any schedule inputs.
```

a. Fly Select Method One is normally used to project monthly flying schedules. It is based on the flying hours projected and uses the average sortie duration to calculate the number of sorties required and the number of aircraft that are required to fly those sorties.

b. Fly Select Method Two is based on sortie flow and is normally used by units that do not fly multiple configurations within the same schedule period. The input is based on numbers of sorties per turn. This method does not allow scheduling based on numbers of sorties per turn. This method does not allow scheduling based on configurations, mission codes, or takeoff and landing times.

c. Fly Select Method Three has two options: mission blocks and individual sortie input. Both of these options allow for scheduling multiple configurations and mission codes.

d. Fly Select Method Four is based on Grid Scheduling and will normally be used by units that fly based on takeoff times. This input is based on the number of rows required, number of columns (goes per day), and increments between takeoff times. Mission codes must be provided in this fly select method to generate sorties.').

end.

topic 'Dock Forecast With Time Change Items'.

say (' #flightcyan DOCK FORECAST WITH TIME CHANGE ITEMS.#d  
#fyellow Option 0 of screen #mASM 84#m provides a monthly inspection dock forecast with required time changes based on the requirements of T.O. 00-20-1. This forecast would normally be used to place time change requirements on order. Actual scheduling of the time change actions for accomplishment during dock inspections is accomplished during the schedule generation. This program should be run 45 to 60 days prior to the affected month.

a. Selection of option 0 retrieves overlay screen ASM # 84A which allows the input of the month being forecasted. The forecast uses the average utilization rate in the MDS scheduling parameters record to estimate the inspection start date. Then it schedules those time changes that fall due between that inspection and the next inspection.

b. Screen ASM # 84B is an overlay to screen ASM # 84A and allows review of the output on the CRT or prints a hard copy of the output.').

end.

topic 'Load/Initiate Schedule Period'.

say (' #flightcyan LOAD/INITIATE SCHEDULE PERIOD.#d  
#fyellow Option 1 of screen #mASM 84#m allows the user to input the scheduling period (monthly, weekly, or daily) in which a schedule is being generated. This process requires input for the start date of the schedule period which is to be generated.

a. To create/generate a schedule, the selection process must be run in the following sequence. Option 1 loads/initiates the schedule period. Option 2 enters known schedule requirements. Option 5 schedules docks, inspections, TCTOs, and flyers.

(1) Option 3 is used if the user wants to only schedule his dock requirement. This is normally used during monthly schedule generation.

(2) Option 4 is used if the user wants to schedule his dock, inspections, and TCTOs. Again, this is used during monthly schedule generation.

(3) Option 9 is used to save any of the options 1 through 5. This will allow the schedule to be saved off into a subdirectory which can be recalled if the user enters option 1 and enter day, month, and year for which the schedule is requested.

b. This process allows schedules to be saved off for quarterly schedule creation. Please read the paragraph that pertains to each option for further explanation.

c. Select option 2 to retrieve screen ASM # 64 which allows user to input any known requirements that will take place during the scheduling period. Press F10 to save input, then press ESC to exit screen. Processing this screen will retrieve screen ASM # 92.

d. Screen ASM # 92 is retrieved after pressing "ESC" from screen ASM # 64. Screen ASM # 92 allows the unit scheduling parameters to be updated or changed. This must be accomplished each time a schedule is input to ensure correct parameters are used. Enter the Fly Select method to be used for validating scheduling rules.

#flightgreen (1) Fly Select Method One.

(a) Screen ASM # 92A is an overlay screen which allows the input of the cross country scheduling option, input the number of hours for the period and the number of spares required for each flying day of the period.

(b) Fly Select Method One is normally used to project monthly flying schedules. It is based on the flying hours projected and uses the average sortie duration to calculate the number of sorties required and the number of aircraft that are required to fly those sorties.

1. If schedule exists for the period being scheduled, and the user elects to revise, then the user should enter "R". This will allow schedule requirements to come up prefilled and allow changes entered as required.

Note: The only changes that are made affect the flying portion of the schedule only.

2. If schedule exists for the period being scheduled, and the user elects to delete, then the user should enter "O". This will allow existing flying portion of schedule to be deleted. All schedule requirements for this period must be entered to generate a new schedule for this period.

Note: To delete a schedule totally from ASM, user must escape to ASM Aircraft directory and delete the save off month (i.e. Oct 90) directory.

- (c) Screen ASM # 28 allows input the cross country requirements. For each cross country sortie, the Tail Nbr is optional; take off and land dates and time and duration for sortie input must be entered. Press enter until the cursor moves through the duration field.
- (d) Screen ASM # 22 allows the user to tell ASM which days are flying, maintenance only, both flying and maintenance or down days. If sorties are not scheduled on a weekend (i.e., Saturday/Sunday) leave blank.
- (e) Overlay screen ASM # 22A displays the total sorties, total hours, start and stop dates of the schedule period input for verification. The user may return to the beginning of the schedule input process where all the screens will be prefilled allowing changes to the inputs.  
Processing this screen will save the inputs.#d

#flightmagenta (2) Fly Select Method Two.

- (a) Overlay screen ASM # 92A. Allows the start date, number of days, start day of the week, and entering the cross country option.
- (b) Fly Select Method Two is based on sortie flow and is normally used by units that do not fly multiple configurations within the same schedule period. The input is based on numbers of sorties per turn. This method does not allow scheduling based on configurations, mission codes, or takeoff and landing times.
- (c) Screen ASM # 28 allows input to the cross country requirements. Upon input of each sortie of the cross country, the user must also enter the tail Number: the take off and land dates and time. ASM will calculate the duration of each sortie input when the enter key is pressed until the cursor moves through the duration field.
- (d) Screen ASM # 22 allows the user to tell ASM which days are flying, maintenance only, both flying and maintenance or down days.

(e) Screen ASM # 25 allows the user to enter schedule by turns. Input the spare requirements and the number of required for each turn only. Press up or down arrows when all turns are input for the first day and the data input will scroll up and display the total sorties and hours for that turn. When using different turns each day, enter the next day requirements. If the same turns are required for each day press down arrows until all days are scheduled. Pressing the up arrow allows the user to scroll back to make corrections as necessary. Pressing F10 will save the inputs. Press the enter or XMIT key to move across from field to field.

(f) Overlay screen ASM # 25A overlay the total sorties, total hours and start and stop dates of the schedule period input for verification. The user may return to the beginning of the schedule input process and all the screens will be prefilled but will allow changes to be made. Processing this screen will save the inputs.#d

#fblack (3) Fly Select Method Three.

Scheduling using Fly Select Method Three has two options, scheduling by mission block and by individual sortie. This method allows for scheduling missions/sorties by configuration and mission codes.

(a) Screen ASM # 92A allows the input of the start date, number of days to schedule, start day of the schedule, cross country option, mission blocks or individual sortie option and sortie sequence number option.

(b) Fly Select Method Three has two options: mission blocks and individual sortie input. Both of these options allow for scheduling multiple configurations and mission codes.

(c) Screen ASM # 28 allows the user to enter cross country requirements. Upon input of each sortie of the cross country, the user must also enter the tail Nbr: the take off and land dates must be the same. ASM will calculate the duration of each sortie input after pressing enter until the cursor moves through the duration field. If the user elects to enter only the cross country mission, input the take off date/time, land date/time, and the total duration of the mission from first take off to last land.

(d) Screen ASM # 22 allows the user to tell ASM which days are flying, surge days, maintenance only, both flying and maintenance or down days.

Note: #mSurge days#m scheduling may only be used with Fly Select Method and sortie generation. This type sortie scheduling may be input with either individual "I" or mission block "M" sorties.

(e) Screen ASM # 66 is only brought up when the option to input individual sorties has been elected. All input fields must contain valid data. When this option is selected the screen will be prefilled with takeoff and land time which is calculated from maintenance start time (takeoff time) (average sortie length) which is input on screen ASM # 92 Scheduling Rules Entry Screen. If surge day (S) was entered for this day, total number of sorties which is scheduled to be flown must be input. This will create the blank line sortie on the ASM 297 schedule. Only first sortie goes will be generated for that particular day.

(f) Screen ASM # 67 is brought up when the option to enter block missions is elected. All input fields must contain valid data. The user must input data for each day of schedule period.

(g) Overlay screen ASM # 67 is displayed when the last day of the schedule period has been scheduled. It displays the total sorties and hours for the schedule period and allows the user to make any corrections or process the screen to save inputs.#d

#### #fwhite (4) Fly Select Method Four.

Scheduling by option 4 will display a grid schedule to allow the scheduling based on takeoff times. A grid schedule is created similar to a spreadsheet. Input the number of rows required, number of columns (goes per day) and increment between takeoff times. The system will generate a spreadsheet-like schedule which allows the user to input the mission code for all required sorties. Takeoff times will be continuous starting with row one and column one and ending with the last row and last column. Leaving the mission code blank will not generate a sortie requirement.

(a) Overlay screen ASM # 92A allows the input of the first date of the schedule, number of days to schedule, start date of schedule, cross country option, and mission code option.

- (b) Fly Select Method Four is based on Grid Scheduling and will normally be used by units that fly based on takeoff times. This input is based on the number of rows required, number of columns (goes per day), and increments between takeoff times. Mission codes must be provided in this fly select method to generate sorties.
- (c) Screen ASM # 28 allows input to cross country requirements. If the user inputs a sortie for cross country, the tail number, takeoff/land time and date, mission code and duration must also be provided.
- (d) Screen ASM # 22 allows the user to input which days are flying, maintenance only, both flying and maintenance or down days. It also allows the input of primary aircraft and spares to be used to generate a schedule for each day.
- (e) Screen ASM # 31 allows the input of data needed to build the Grid Schedule by allowing input to the number of GOs (turns per aircraft), Primary aircraft (Enter the CAP) time increment between sorties and start time for that days schedule. It will calculate the start time for each GO after pressing XMIT based on information provided through earlier inputs.
- (f) Overlay screen ASM # 31A will come up after input of correct data for flow, showing the scheduled take-off times.
- (g) Screen ASM # 33 allows the user to tag mission code(s) needed to fly at the time on the schedule.').
- end.

```
topic 'Dock Scheduling Module ASM #84A'.
say ('#flightcyan DOCK SCHEDULING MODULE ASM # 84A.#d
#fyellow
a. This screen is reached by calling up option 3, Schedule Print Program, of screen #mASM 84#m. This option actually schedules the dock inspection plus any inspection and or time changes that will come due during inspection period. This process uses scheduling parameters/rules input by the user during the initialization process and the schedule requirements previously input.
```

(1) Overlay screen ASM # 84A will start the actual dock generation process if the enter/return key is pressed. Pressing the ESC key allows the user to return to the menu if this program was incorrectly selected.

(2) Screen ASM # 64 allows the update of any special events which may have loaded.

(3) Screen ASM # 59 displays the aircraft ID that has been scheduled for a dock inspection plus any other maintenance actions that are either due or overdue plus any time changes that will come due before the next inspection. Additionally, any TCTOs that are currently in a workable status are displayed. Tag those actions that need to be accomplished in conjunction with the dock inspection and they will be scheduled.

Note: This screen will come up as often as necessary to schedule all the dock inspections required based on the number of inspection docks operated for the MDS being scheduled. The following messages will appear and alternate while the actual scheduling operation is in progress. The "#microcomputer#" must be allowed to complete this task without intervention by the operator.

b. This screen is reached by calling up option 4, Schedule Print Program, of screen #ASM 84#. This option actually schedules the docks, inspections, and TCTOs that will come due during inspection period. This process uses scheduling parameters/rules input by the user during the initialization process and the schedule requirements previously input. Pressing the ESC key allows the user to return to the menu if this program was incorrectly selected.

(1) Screen ASM # 64 allows the update of any special events which may have loaded.

(2) screen ASM # 59 displays the aircraft ID that has been scheduled for a dock inspection plus any other maintenance actions that are either due or overdue plus any time changes that will come due before the next inspection. Additionally, any TCTOs that are currently in a workable status are displayed. Tag those actions that need to be accomplished in conjunction with the dock inspection and they will be scheduled.

NOTE: This screen will come up as often as necessary to schedule all the dock inspections required based on the number of inspection docks operated for the MDS being scheduled.

The following messages will appear and alternate while the actual scheduling operation is in progress. The microcomputer must be allowed to complete this task without intervention by the operator.

c. This screen is reached by calling up option 5, Schedule Print Program, of screen #mASM 84#m. This option actually schedules the maintenance and flying requirements from the database. This process uses scheduling parameters/rules input by the user during the initialization process and the schedule requirements previously input.

(1) Overlay screen ASM # 84A will start the actual schedule generation process if the enter/return key is pressed. Pressing the ESC key allows the user to return to the menu if this program was incorrectly selected.

(2) Screen ASM # 64 allows the update of any special events which may have loaded.

(3) Screen ASM # 59 displays the aircraft ID that has been scheduled for a dock inspection plus any other maintenance actions that are either due or overdue plus any time changes that will come due before the next inspection. Additionally, any TCTOs that are currently in a workable status are displayed. Tag those actions that need to be accomplished in conjunction with the dock inspection and they will be scheduled.

NOTE: This screen will come up as often as necessary to schedule all the dock inspections required based on the number of inspection docks operated for the MDS being scheduled. The following messages will appear and alternate while the actual scheduling operation is in progress. The #mmicrocomputer#m must be allowed to complete this task without intervention by the operator.

').

end.

```
topic 'Modify Schedule Screen ASM # 84'.
say (' #flightcyan MODIFY SCHEDULE SCREEN ASM # 84.#d
#fyellow This screen is reached by calling up option 6 of the Schedule
Print Menu, screen #mASM 84#m. The use of this option allows
the ASM maintenance schedule to be modified by the user. Care
must be taken when using this option since it will disregard
all current scheduling parameters/rules in ASM.
```

a. Screen ASM # 84A displays a reminder of the need for a hard copy of the schedule before proceeding and allows the user to quit and return to the appropriate menu to get the hard copy before proceeding.

b. Screen ASM # 74 allows only maintenance actions to be rescheduled, added to, or deleted from the schedule. To add a new action, enter only those required fields on the right side of the screen. To delete an action input only those fields on the left side of the screen. To reschedule an action input all the fields on the left side and the date only on the right side. ).

end.

topic 'Update Sortie Information Screen ASM #84'.  
say ('

\*flightcyan UPDATE SORTIE INFORMATION SCREEN ASM # 84.#d  
#fyellow This screen is reached through option 7. This allows the user the capability to add the pilots name, aircraft configuration, fuel load, range area, time on target, call sign and additional remarks to the flying schedule.

a. Screen ASM # 84A will come up allowing input to the date(s) of the schedule.

b. Screen ASM # 99 will come up allowing changes to the data elements.').

end.

topic '\*Display/Print Schedules ASM #85\*'.  
say ('

\*flightcyan DISPLAY/PRINT SCHEDULES #mASM 85#m.#d  
#fyellow This screen is reached by calling up option 8, Main Menu, which allows the user to select options to display or print schedules generated by ASM.').

end.

topic 'Schedule Print Menu Screen ASM #85A'.  
say (' \*flightcyan SCHEDULE PRINT MENU ASM # 85A.#d  
#fyellow

This screen is reached by calling up option 1, Schedule Print Menu, screen #mASM 85#m. Screen ASM # 85A displays the weekly/monthly schedule (AF FORM 2401 and 2402) on the screen for review. The weekly schedule will be in an 80-column format and can be scrolled up or down for review. The monthly schedule will be in a 132 column format and can be scrolled up, down, right, or left for review. The user must enter the date(s) of the schedule period to be viewed.

a. Screen ASM # 85B gives the option of printing these schedules. Any schedule period longer than 7 days will require 13.5-inch by 11-inch paper in the printer or use 17 pitch print for 8.5 inch by 11-inch paper. Samples of the printed schedules are provided in attachment 2.').

end.

topic 'Display/Print Daily Flying Schedule Screen ASM # 85A'.  
say ('

#flightcyan DISPLAY/PRINT DAILY FLYING SCHEDULE SCREEN ASM #  
85A.#d #fyellow

This screen is reached by calling up option 2.  
Schedule Print Menu, screen #mASM 85#m. This screen  
displays and prints a facsimile of the daily  
flying schedule (AF FORM 2436). A sample of  
the form is provided in attachment 3.

a. Screen ASM # 85A allows the input of the date(s)  
of the required schedules.

b. Screen ASM # 85B provides the capability to review  
the schedule on the CRT, print a hard copy, or exit if  
reviewed on the screen only.').

end.

topic 'Schedule Grid Format Screen ASM #85A'.

say (' #flightcyan DISPLAY/PRINT DAILY FLYING SCHEDULE GRID FORMAT

SCREEN ASM # 85A.#d

#fyellow

This screen is reached by calling up option 3, Schedule Print  
Menu,screen #mASM 85#m. Displays and prints a daily flying  
schedule in a grid format. The daily schedule will be in a  
132-column format and can be scrolled up,down, right, or left  
for review. Printing these schedules will require 13.5-inch  
x 11-inch paper in the printer or 17-pitch print for 8.5-inch  
x 11-inch paper. A sample of the form is provided on page  
A5-1.

a. Screen ASM # 85A allows the input of the date(s) of the  
required schedules or press F10 to accept default date. The  
capability to select by flight code is currently not useable;  
so press "Enter" to continue.

b. Screen ASM # 85C will come up allowing the user to enter  
the flight code that the sorties were scheduled under. Press  
"Enter" if no codes were used.

c. Screen ASM # 85B allows the capability to review  
the schedule on the CRT, print a hard copy, or exit if  
reviewed on the screen only.').

end.

topic 'Display/Print Flying Schedule TAC Form 297 Screen ASM #85A'.  
say ('  
#flightcyan DISPLAY/PRINT DAILY FLYING SCHEDULE TAC FORM 297 SCREEN  
ASM # 85A.#d  
#fyellow This screen is reached by calling up option 4, Schedule  
Print Menu screen #mASM 85#m. The screen displays or  
prints a daily flying schedule in TAC form 297 format.  
  
a. Screen ASM # 85A allows the input of the date(s) of the  
required schedule.  
  
b. Screen ASM # 85B allows the capability to review the  
schedule on the CRT, print a hard copy, or exit if  
reviewed on the screen only.').  
end.  
  
topic 'Display/Print Abbreviated Daily Flying Schedule'.  
say ('  
#flightcyan SCHEDULE PRINT MENU SCREEN ASM # 85A DISPLAY/PRINT  
ABBREVIATED DAILY FLYING SCHEDULE.#d  
#fyellow This screen is reached by calling up option 5 schedule  
print menu screen #mASM 85#m. Screen ASM # 85A displays  
or prints equipment ID,takeoff, and landing times.  
  
a. Screen ASM # 85A allows the input of the date(s) of the  
required schedule. See attachment 7.  
  
b. Screen ASM # 85B allows the capability to review  
the schedule on CRT, print a hard copy, or exit if  
reviewed on the screen.').  
end.

topic 'Schedule Print Menu Screen ASM #85D'.  
say ('#flightcyan SCHEDULE PRINT MENU SCREEN ASM # 85D  
DISPLAY/PRINT DAILY MAINTENANCE SCHEDULE.#d  
#fyellow This screen is reached by calling up option 6,  
Schedule Print Menu, screen #mASM 85#m. It displays and  
prints a daily maintenance schedule in column format by day.  
  
a. Screen ASM # 85D allows the capability of selecting the  
maintenance page by using option "E" for equip ID for a  
scheduled period or option "D" for a specific date.  
  
b. Entering option "E" for equip ID will bring up  
screen ASM # 57, the capability to tag these aircraft  
for review. Screen ASM # 57A provides the capability  
to review the schedule on the CRT or print a hard copy  
or exit if reviewed on the screen only.

- c. Screen ASM # 85B will appear allowing the capability to review the maintenance schedule on the CRT, print a hard copy, or exit if reviewed on the screen only.
- d. Screen ASM # 85A will appear when option "D" has been selected, allowing the user to view the maintenance by a date or dates.
- e. Screen ASM # 85B allows the capability to review the maintenance schedule on the CRT, print a hard copy, or exit if reviewed on the screen only.').

end.

topic '\*Utility Programs Menu Screen ASM #86\*'.  
say ('

#flightcyan UTILITY PROGRAMS MENU SCREEN #mASM 86#m.#d  
#fyellow This screen is reached by calling up option 4, Main Menu, screen #mASM 82#m. This option allows the user to utilize programs that will produce management products; add, change, or delete inspections or time changes; update scheduling rules and parameters; etc.').

end.

topic 'Automated Scheduling Module Aircraft Data Menu Screen ASM #87'.  
say (' #flightcyan AUTOMATED SCHEDULING MODULE AIRCRAFT DATAMENU SCREEN ASM # 87.#d #fyellow

This screen is reached by calling up option 1, Utility Programs Menu, screen #mASM 86#m. It allows the user to produce Time Distribution Indexes (TDI), review or print aircraft standings, review or print TCTO data, update airframe data, and update special event records.

a. TDI-Recurring Actions Screen ASM # 87A. This screen is reached by calling up option 1, Aircraft Data Menu Screen ASM # 87. This screen creates a TDI for any inspection or time change being tracked by ASM and gives the option to print the same.

(1) Screen ASM # 87A allows the user to select a JST number or action code.

(2) Screen ASM # 87B provides the capability to review the schedule on the CRT or print a hard copy or exit if reviewed on the screen only.

b. TDI-Next Dock Inspection Screen ASM # 87B. This screen is reached by calling up option 2/Aircraft Data Menu screen ASM # 87. This screen creates a TDI for the next dock inspection due for all aircraft with an indication of which inspection is coming due for each and gives the option to print the same.

c. TDI-Recurring Actions for Future Date, Screen ASM # 87A. This screen is reached by calling up option 3, Aircraft Data Menu, screen ASM # 87. This screen creates a TDI for any inspection or time change being tracked by ASM using the current schedule and projecting the due times at a future date based on the assumption that all currently scheduled inspections will be completed as scheduled. For those recurring actions that have a type interval of hours ASM uses current scheduled sortie durations and the average calendar utilization rate to project due dates and hours.

(1) Screen ASM # 87B provides the capability to review the schedule on the CRT or print a hard copy or exit if reviewed on the screen only.

d. TDI-Dock Inspections for Future Date Screen ASM # 87B. This screen is reached by calling up option 4/Aircraft Data Menu, screen ASM # 87. This screen creates a TDI for the next dock inspection using the same process as described in paragraph 4.3.3.4.1b.

(2) Screen ASM # 87B provides the capability to review the schedule on the CRT or print a hard copy or exit if reviewed on the screen only.

(1) Screen ASM # 87A allows selection of the record type to be updated.

(2) Screen ASM # 87B allows the user to enter the equipment ID number for records to be updated.

(3) Screen ASM # 17 allows the selection of the actual record to be updated within the database.

g. TCTO Data Screen ASM # 87A. This screen is reached by calling up option 7, Aircraft Data Menu, screen ASM # 87. This screen provides two options to review workable TCTO data, first by aircraft ID number listing the TCTO number and the grounding date; second by TCTO number listing the affected aircraft ID numbers.

(1) Screen ASM # 87A provides the capability to enter the option for reviewing TCTO data, either by aircraft ID or by TCTO number.

(2) Screen ASM # 72 is displayed when option 1 is selected from screen ASM # 87A.

(3) Screen ASM # 73 appears when option 2 is selected from screen ASM # 87A.

- (4) Screen ASM # 73A provides the capability to review the schedule on the CRT or print a hard copy or exit if reviewed on the screen only.
- h. Change Basic Airframe Data Screen ASM # 87. This screen is called up, reached through option 8, Aircraft Data Menu, screen ASM # 87. Use this option to change aircraft data as displayed on the screens below.
- (1) Screen ASM # 60 will be brought up prefilled with all aircraft loaded to database, allowing changes to be made and processed into the database.
- i. Add/Modify or Delete Special Events Screen ASM # 64. This screen is reached by calling up option 9, Aircraft Data Menu, screen ASM # 87. This option the user to add, change or delete special events. Examples may include programmed depot maintenance, alert commitments, static displays, etc.

NOTE: Screen ASM # 64 will come up if there are special events records on the database. This will allow the user the options of adding, deleting, or modifying an action, or updating a completed dock.').

end.

```
topic 'Automated Scheduling Module--Aircraft Update Screen ASM #86'.
say (' #flightcyan AUTOMATED SCHEDULING MODULE--AIRCRAFT UPDATE SCREEN
ASM # 86.#d
#fyellow
This is reached by calling up option 2, Utility Programs
Menu, screen #mASM 86#m. Use this option to add an
aircraft. After the aircraft is loaded into CAMS, the CAMS
data retrieval will automatically load newly assigned
aircraft to the ASM database. When adding an aircraft, the
due times for each inspection and time change, all TCTO
requirements, and current airframe hours must be
available.
```

- a. Screen ASM # 86A provides a means for selecting the type of action to take or exiting the program/screen without any action.

Note: Deleting an aircraft requires that only the aircraft ID number be entered. If an aircraft is erroneously deleted processing the CAMS data retrieval into the ASM database will reload the aircraft. Any new aircraft gained should be added using this method.

- b. Screen ASM # 86B will appear when option A is selected from the previous screen.
- c. screen ASM # 86C will appear allowing the user to enter the MDS of the aircraft being added.
- d. Screen ASM # 86D displays a reminder to the user of the type of data necessary for adding an aircraft to the database. This process must be completed for each aircraft being added. When the first one is completely loaded, the next may be started.
- e. Screen ASM # 42 will be brought up following screen ASM # 86D and accept data necessary to add an aircraft to the database. The aircraft ID and its flying hours must be entered only the first time. When entering part number/serial number items, all fields must be completed except the position. The due hour or due date field is entered depending on the type interval input.
- f. Screen ASM # 42A allows the current operating time of the aircraft being added.
- g. Screen ASM # 29 allows the user to tag those mission codes that apply to the aircraft being added provided the user has elected to use configuration codes in scheduling the aircraft.
- h. Screen ASM # 30 allows the user to tell ASM what the current configuration is of the aircraft being added again provided that option is selected.
- i. Screen ASM # 45 allows the input of all TCTOs that are in a workable status for the aircraft being added.
- j. Screen ASM # 86E will appear when option "D" is selected from screen ASM # 86A allowing a second chance before deleting the aircraft entered.').

end.

```
topic 'Review/Change Scheduling Parameters Screen ASM # 88'.
say (' #flightcyan REVIEW/CHANGE SCHEDULING PARAMETERS SCREEN ASM #
88.#d
#fyellow
```

This screen is reached by calling up option 3, Utility Programs Menu, screen #mASM 86#m. This program provides the capability to change the MDS scheduling parameters created during ASM initialization. These parameters may be changed any time but will not affect the database or current schedules. Changes will affect future schedules.

- more to follow -

a. Action Rules Update Screen ASM # 5. This screen is reached by calling option 1, Scheduling Parameters Menu, screen ASM # 88. This program allows the user to add, change or delete all the recurring action rules from the database. This action does not delete any actual inspection or time change records from the database only, the rules they are scheduled by. The next processing of the download will automatically delete the actual inspection or time change records. When using option 1 or 2, additional screens will appear for input of data or changing the data. When using option 3 an additional screens will appear prefilled allowing a second chance before processing the request for deletion. Option 4 provides a listing of all the parameters for each inspection or timechange that were selected to have ASM track and schedule.

- (1) Screen ASM # 5 is a menu of the options available within this program.
- (2) Screen ASM # 5A will appear when option 1 is selected allowing the user to input the JST number of the action which needs to be added.
- (3) Screen ASM # 5B will appear up allowing the user to enter the narrative for the JST number loaded.
- (4) Screen ASM # 6 will appear allowing the user to input all the needed information for the action being loaded.
- (5) Screen ASM # 93 will appear allowing the capability to tag all these actions that are compatible with the new action.
- (6) Screen ASM # 9 will appear next allowing the capability to add the action to every aircraft in the database. The equip ID will change every time the screen is processed, until it has gone through all the aircraft, then, it will go on to the next screen.
- (7) Screen ASM # 90 will now appear allowing changes to the relative priority of the maintenance actions.

b. Screen ASM # 5A will appear when option 2 is selected from the program menu allowing the user to enter either the action code or JST number to be changed.

(1) Screen ASM # 7 will appear prefilled when option 2 is selected from the program menu, and will allow changes that will automatically update all aircraft or part number serial number records within the database affected by these requiring action rules/parameters.

c. Screen ASM # 5A appears when option 3 is selected. Enter an Action Code or JST number to change maintenance compatibility.

(1) Screen ASM # 93 will appear allowing changes to the maintenance compatibility.

d. Screen ASM # 90 appears when option 4 is selected, allowing changes to the relative priority of recurring actions. When executing option 4, a relative priority of recurring actions is computed based upon unit-established scheduling parameters. Unless a change to the scheduling parameters is made, the priority displayed when running option 4 will always be the same. Once a change is made to the relative priority, it must be verified by selecting option 6, Print All Records. Enter "Y" to proceed with changing the relative priorities, "N" to return to the main menu.

(1) Screen ASM # 5A appears when option 5 is selected from screen ASM # 5, allowing the capability to input an action code or JST number to be deleted

(2) Screen ASM # 7 will appear allowing a second chance before deleting a specific action code.

(3) Screen ASM # 5B will appear stating "You know that you must reset your printer to (17 CPI) to receive a printed copy of all your current maintenance actions."

f. Add/Change/Delete Configuration Codes Screen ASM # 23. This screen is reached by calling up option 2, Scheduling Parameters Menu, screen ASM # 88. This screen allows configuration rules to be added changed or deleted. Current schedule will not be affected, any codes added, changed, or deleted will only affect future schedules.

(1) Screen ASM # 23 will appear allowing input of the configuration code to be added, changed or deleted.

(2) Once a configuration code is entered screen ASM # 23A will appear allowing the user to tag those aircraft that can fly.

g. Mission Code Entry Screen ASM # 34. This screen is reached by calling up Option 3, Scheduling Parameters Menu, screen ASM # 88. This screen allows mission codes to be added changed or deleted. Current schedule will not be affected, any codes added, changed, or deleted will only affect future schedules.

(1) Screen ASM # 34 will appear allowing input of a mission code that to be added, changed or deleted.

(2) Screen ASM # 34A will then appear allowing the user to tag aircraft needed to fly those specific missions.

h. Update Inspection Dock Records Screen ASM # 35. This screen is reached by calling up option 4, Scheduling Parameters Menu screen ASM # 88. This screen allows the user to review and change the inspection dock parameters.

(1) Screen ASM # 35 will allow changes to be made to the primary inspection dock record; then, based on the type of changes made, allow changes to be made to the individual dock records if necessary.

(2) Screen ASM # 36 provides the capability to change individual inspection dock records when necessary.

i. Scheduling Rules Entry Screen ASM # 92. This screen is reached by calling up option 5, Scheduling Parameters Menu, screen ASM # 88. Screen ASM # 92 allows the user to review the scheduling parameters for a particular MDS and change or update those rules.

j. TCTO Rules Update Screen ASM # 97. This screen is reached by calling up option 6, Scheduling Parameters Menu, screen ASM # 88.

(1) Screen ASM # 97 allows the user the capability to add, change, or delete TCTOs.

k. Special Events Narrative Change Screen ASM # 94. This screen is reached by calling up option 7 Scheduling parameters menu, screen ASM # 88.

(1) Screen ASM # 94 will appear allowing the users the capability to add, change, or delete any special event they may want to use.').

end.

topic 'Upload Flying Maintenance Schedule to CAMS'.  
say (' #flightcyan UPLOAD FLYING MAINTENANCE SCHEDULE TO CAMS.#d  
#fyellow

To use this capability, enter "Upload" from  
the ASM directory and enter the appropriate MDS  
needed to upload (i.e., C:\ASM>UPLOAD -KC135R-).

NOTE: User must ensure CHI is installed at this point.  
Procedures are outlined for this in AFM 66-279, volume I.  
If CHI is not installed, screen overlay will be displayed.

a. Screen ASM # 40 will allow the capability to load  
the flying and or maintenance schedule to the CAMS  
mainframe. This screen is retrieved after successfully  
processing the upload.

b. Screen ASM # 40A is displayed when any option of  
screen ASM # 40 is entered. To insure proper sign is  
completed, do not interrupt.

c. Screen ASM # 39 is retrieved if option 1 or 3 is  
entered from screen ASM # 40. It is only displayed  
if forms indicator is set at schedule input on screen  
ASM # 94.

d. Screen ASM # 39A is displayed if option 1 or 3 is  
entered. This is displayed to allow input for  
maintenance action scheduled start time.

e. Screen ASM # 79 is displayed if "D" is entered in  
screen ASM # 39A to allow the user to change the  
scheduled maintenance actual start time.

f. A Screen overlay will be displayed when processing  
transaction to mainframe. Please do not interrupt  
until complete.

g. A screen overlay will be displayed after upload  
is complete and the number of processed/rejected  
transactions are displayed.').

end.

topic 'Related Processing'.  
say (' #flightcyan RELATED PROCESSING.#d  
#fyellow

The database routines are initiated by the COBOL programs  
and require no user intervention or file maintenance to  
delete old or outdated records. The only files that the user  
will be responsible for deleting are outdated backup files or  
those databases that were backed up as part of the "what if"  
or "wrap around" functions. The actual ASM programs and the  
files it creates should never be deleted or erased.').

end.

```
topic 'Data Backup'.
say (' #flightcyan DATA BACKUP.#d
#fyellow MS-DOS commands are used for this purpose. Two batch files
have been provided to aid the user in performing these
vital tasks. To use them the user must first exit ASM as
discussed in paragraph 3.3. When the user has exited and
the MS-DOS prompt (C:\ASM\>) is visible, insert a blank
formatted floppy disk in the "A" drive and input "BACKUP
(subdirectory)" and press enter. Label the disk(s) with
the subdirectory and the volume number equal to that of the
prompt from the backup commands. To restore the database,
insert the floppy disk labeled Volume one into drive "A"
and enter "RESTORE (subdirectory)". The user will be
prompted to change disks by the system if the database
exceeds the storage capacity of one floppy disk.
```

#### SAMPLE INPUTS

```
BACKUP DOS -KC135A-
RESTORE DOS -KC135A-
```

(DOS being the subdirectory that contains the MS-DOS commands.  
The format for the subdirectory entry must be preceded by the  
dash(s) as indicated, e.g. --F015A-, --B001B-)

NOTE: The backups may be the only source for recovering data  
lost during system crashes or disk errors! Periodic backups  
are extremely important and the small amount of time taken to  
process the backup may save hours of reentering data.').

end.

topic 'Recovery from Errors and Malfunctions'.

```
say (' #flightcyan RECOVERY FROM ERRORS AND MALFUNCTIONS.#d
```

#fyellow

Recovery from errors and malfunctions vary depending on  
the type of error or problem encountered. In the worst  
case, where all information has been erased from the hard  
disk, simply follow the procedures in paragraph 3.1.3.3  
to reload the ASM system. Then perform the restore  
function described in paragraph 4.5. Next re-input  
the data that was lost since the last backup.').

end.

topic 'Messages'.

```
say (' #flightcyan MESSAGES.#d
```

#fyellow Normal errors will be displayed. However, when a fatal error  
is detected, all processing will be terminated and the  
Mission, Design, and Series (MDS) will be displayed. To  
assist in troubleshooting, the user must document the screen  
number and the input, if applicable, that caused the error.  
Fatal errors will appear on the screen; reentry of the  
input that caused the error may be required to verify an  
accurate error message. Call the Field Assistance Branch  
for assistance if the user cannot continue. ').

end.

```
topic 'ASM EXPERT SYSTEM JOB AID'.
Window ('ASM EXPERT SYSTEM JOB AID',red,lightgray,YELLOW,1,1,78,18).
say ('      An expert system is almost exactly what it sounds like:  
      a computer program which performs the same role as a human  
      expert. It has detailed knowledge of some specific area,  
      called a "domain". It asks the user questions and then provides  
      an answer. Expert systems alone do not give the user of an  
      application any control over the system. The paths to the  
      solution of a problem is decided by the answer to questions  
      asked by the system. The same answers will always send the  
      user down the same path. Hypertext systems focus more on  
      displaying informational messages. KnowledgePro, the  
      application this Expert System was built with has a terrific  
      hypertext maker. Therefore, this program does not heavily rely  
      on the rule-based implementation that traditional expert system  
      shells use. It is also an aid to the user, because he/she  
      should be able to use this application simultaneously while  
      working in ASM. Good Luck Schedulers and Happy Landings.').
close_window ()�
end.
```

```
topic 'ASM 81'.
window ('',green, black, white,1,7,
```

```
78,13).
say ('WHICH DATABASE DO YOU WISH TO USE:#flightgray 0#d
#fcyan

DATABASE 1: #flightgray F016C#fcyan
DATABASE 2: #flightgray KC135A#fcyan
DATABASE 3:
DATABASE 4:
DATABASE 5:
DATABASE 6:
DATABASE 7:
DATABASE 8:
DATABASE 9:
').

```

```
WINDOW ('',RED,BLACK,WHITE,1,1,78,3).
SAY (' ASM # 81 *      MDS Selection Menu      *
      F1 = Help / #MF2Edit Setup#M / F10 = Save Setup / ESC = Edit ASM
').
```

```

window ('',red,black,white,1,22
       ,78,3).
say (' Enter the number of the #mdatabase#m you wish to work with (e.g.
8').
close_window (window_list ()).
end.

topic 'Send'.
window ('5. Section Four, Processing Reference Guide',black,white,
cyan,1,1,78,
20,).
close_window (window_list ()).
end.

topic 'Database'.
window ('Database',green,red,lightgray,5,15,75,6).
say (
      Database, technically speaking, is a large amount of data
      stored in a well organized format. In this case, it refers to
      the data from the #mMission Design Series (MDS)#m you have
      chosen in the middle of screen ASM # 81 (i.e F-16C,
      KC-135A').
close_window().
end.

topic 'Mission Design Series (MDS)'.
window ('Mission Design Series - MDS',black,white,red,5,10,78,7).
say (
      MDS is a convention used to explain the aircrafts mission,
      designation and series. For example, F-15A refers to
      an aircraft with a Fighter mission, which was designated 15
      due to the acquisition process, and has a series of A, which
      means it was the first model in the F-15 fleet.').
close_window().
end.

topic 'F2Edit Setup'.
window ('',blue,lightgray,red,3,10,78,8).
say (
      This key is actually pressed before any other key when
      creating a new directory for a specific MDS. The sequence is
      as follows: Press F2 (this puts the user in the Edit mode),
      then type in whichever MDS you will want to access, followed
      by pressing the F10 key to save the entry.').
CLOSE_WINDOW ().

end.

```

```
topic 'ASM 82'.
window ('',green, black,white,1,7,78,13).
say ('#Fcyan
```

1. Update/Initialize ASM Database
2. Generate a Schedule
3. Print a Schedule
4. Utility Programs

```
ENTER OPTION:#d
').
```

```
WINDOW ('',RED,BLACK,WHITE,1,1,78,3).
SAY ('#fyellow
ASM 82      #fred *#fgreen          MAIN MENU
#fred * #fgreen    MDS: #fyellow F016C#d
#fyellow      ESC#d#fgreen = #d#fgreen Previous
Menu#d
').
```

```
window ('',green,black,white,1,22
,78,3).
say (' Enter the number of the function you wish to execute ... ').
close_window (window_list ()).
end.
```

```
topic 'ASM 83'.
window ('',green, black,white,1,7,
```

```
78,13).
say ('#Fcyan
```

1. Initialize ASM Data Base from CAMS Download Data
2. Initialize ASM Data Base from User Input
3. Update ASM Data Base from CAMS Download Data
4. Update ASM from Previous Schedule

```
ENTER OPTION:#d ').
```

```
WINDOW ('',RED,BLACK,WHITE,1,1,78,3).
SAY ('#fyellow
    ASM 83      #fred *#fgreen      UPDATE/INITIALIZE DATA BASE
    #fred * #fgreen   MDS: #fyellow F016C#d
                #fyellow      ESC#d#fgreen = #d#fgreen Previous
Menu#d
').
```

```
window ('',green,black,white,1,22
,78,3).
say (' Enter the number of the function you wish to execute ... ').
close_window (window_list ()).
end.

topic 'ASM 84'.
window ('',green, black,white,1,7,
```

```
78,13).
say ('#Fcyan
    0. Dock Time Change Forecast
    1. Load/Initiate Schedule Period
    2. Enter Known Schedule Requirements
    3. Schedule Docks
    4. Schedule Docks, Inspections & TCTOs
    5. Schedule Docks, Inspections TCTOs & Flyers
    6. Modify Schedule
    7. Update Sortie Information
    8. Display/Print a Schedule
    9. Save Current Monthly Schedule
ENTER OPTION:#d
').
```

```
WINDOW ('',RED,BLACK,WHITE,1,1,78,3).
SAY ('#fyellow
    ASM 84      #fred *#fgreen      SCHEDULE PRINT MENU
    #fred * #fgreen   MDS: #fyellow F016C#d
                #fyellow      ESC#d#fgreen = #d#fgreen Previous
Menu#d
').
```

```
window ('',green,black,white,1,22
,78,3).
say (' Enter the number of the function you wish to execute ... ').
close_window (window_list ()).
end.
```

```
topic 'ASM 85'.
window ('',green, black,white,1,7,
78,13).
say ('#Fcyan
    1. Display/Print Weekly/Monthly Schedule
    2. Display/Print Daily Flying Schedule (AF Form 2436)
    3. Display/Print Daily Flying Schedule (Grid Format)
    4. Display/Print Daily Flying Schedule (TAC Form 297)
    5. Display/Print Abbreviated Daily Flying Schedule
    6. Display/Print Daily Maintenance Schedule
                                ENTER OPTION:#d
').
```

```
WINDOW ('',RED,BLACK,WHITE,1,1,78,3).
SAY ('#fyellow
    ASM 85      #fred *#fgreen          SCHEDULE PRINT MENU
    #fred * #fgreen  MDS: #fyellow F016C#d
                                #fyellow      ESC#d#fgreen = #d#fgreen Previous
Menu#d
').
```

```
window ('',green,black,white,1,22
,78,3).
say (' Enter the number of the function you wish to execute ... ').
close_window (window_list ()).
end.
```

```
topic 'ASM 86'.
window ('',green, black,white,1,7,
```

```
78,13).
say ('#Fcyan
```

1. #mDisplay/Print Aircraft Data#m
2. #mAdd or Delete Aircraft#m
3. #mReview/Change Scheduling Parameters#m

```
ENTER OPTION:#d').
```

```

WINDOW ('',RED,BLACK,WHITE,1,1,78,3).
SAY (#fyellow
     ASM 86      #fred *#fgreen      UTILITY PROGRAMS MENU      #fred
* #fgreen    MDS: #fyellow F016C#d
                           #fyellow      ESC#d#fgreen = #d#fgreen Previous
Menu#d
').

window ('',green,black,white,1,22
,78,3).
say (' Enter the number of the function you wish to execute ... ').
close_window (window_list ()).
end.

topic 'Display/Print Aircraft Data'.
window ('Display/Print Aircraft Data',red,lightgray, green,5,8,75,7).
say (
      Screen ASM 86, option 1 leads you to various aircraft data,
      including TDIs, Aircraft Standings, Recurring Actions for an
      Aircraft, TCTO Data for an Aircraft, Change Basic Airframe Data,
      and Update Special Events Data selections.').
end.

topic 'Add or Delete Aircraft'.
window ('Add or Delete Aircraft',red,lightgray, green, 1,1,78,19).
say (' Screen ASM 86, option 2 is used to add or delete aircraft.
      This space would, in a full-up version, give the associated
      expertise of how the scheduler should enter data to add or
      delete aircraft.  Hit the SPACE BAR now, to retrieve more
      information about adding/deleting aircraft.  Use PgDn and
      PgUp to see the entire section.  After reviewing the entire
      section, hit the SPACE BAR again to return to the screen').
do ('Automated Scheduling Module--Aircraft Update Screen ASM #86').
close_window (window_list ()).
end.

topic 'Review/Change Scheduling Parameters'.
window ('Review/Change Scheduling
Parameters',red,lightgray,green,5,8,75,7).
say (
      Screen ASM 86, option 3 is used to review or change scheduling
      parameters.  Again, the experts knowledge would be entered
      here.').
end.

```

```
topic 'microcomputer'.
window ('',red,lightgray,green,5,8,75,4).
say ('          A small, complete computer system. Most of the Air Force
      users are using either the 286 Zenith models or the newer 386
      Desktop Three microcomputers purchased from Unisys Corporation').
close_window().
end.

topic 'user friendly'.
window ('',red,lightgray,green,5,8,75,8).
say ('          Hardware or software designed to help people become familiar
      with their computer/computer programs. Usually includes simple
      and easy to follow instructions. For example, the ASM Expert
      System Job Aid, created by Capt Kevin Gore, AFIT/GLM/DEV as part
      of his Thesis Project is one such product').
close_window().
end.

topic 'Surge days'.
window ('',red,lightgray,green,5,8,75,6).
say ('          According to TACR 60-5, a surge is 50% overflight of scheduled
      sorties for a Combat Coded (CC) wing, and 25% overflight of
      scheduled sorties for a Training (TW) wing').
close_window().
end.

topic 'expert system shell'.
window ('',red,lightgray,green,5,8,78,9).
say ('          An expert system is a computer program which performs the
      same role as a human expert, or imparts information that an expert
      would possess. The expert system shell is simply the software
      package that the creator of the "expert system" uses to create his
      product. Most of these shells are relatively easy to use, because
      they are designed with the non-programmer in mind').
close_window().
end.
end.
```

### Bibliography

1. Badiru, Adedeji B., and others. "AREST: Armed Robbery Eidetic Typing Expert System," Journal of Police Science and Administration, 16: 210-215, (July 1988).
2. Bereit, Lt Col Rick., Assistant Deputy Commander for Maintenance. Personal Interview. 52 TFW, Spangdahlem AB Spain, 13 August 1991.
3. Carr, Clay. "Computer Marriage Work," Training and Development Journal, 42: 66-74, (May 1988).
4. -----. "Designing Systems for the 90s," Performance Improvement Quarterly, 3: 14-26, (January 1990).
5. -----. "Expert Systems: What do they mean for Training?," Training, 26: 41-48, (December 1989).
6. -----. "Skilling America: The Potential of Intelligent Job Aids," Educational Technology, 28: 22-25, (April 1988).
7. -----. "Using Expert System Job Aids: A Primer," Educational Technology, 29: 18-22, (June 1989).
8. Daly, Raymond T. et al. Executive Handbook for Stock Fund Managers. Montgomery AL: Air Force Logistics Management Center, July 1991.
9. Department of the Air Force. Core Automated Maintenance System (CAMS) Functional Description FD-G83-004 Supplement VA. Washington: HQ USAF, 15 October 1988.
10. Department of the Air Force. Core Automated Maintenance System (CAMS) DSD: G054/FS, Automated Scheduling Module (ASM) End User Manual. AFM 66-279, Volume XXI. Washington: HQ USAF, 1 December 1990.
11. Diamondstone, Jan. "The Workplace as Upstairs, Downstairs." CBT Directions, 4: 24-33, (April 1991).
12. Evans, Ron. "Expert Systems and Hypercard," Byte, 15: 317-324, (January 1990).
13. Everett, Ron., Supervisor. Plans Scheduling and Documentation. Telephone interview. 97th SBW/MAMX, Eaker AFB, 19 August 1991.
14. Feigenbaum, Edward A. et al. The Rise of the Expert Company. New York: Random House, Inc., 1988.
15. Gery, Gloria. "Electronic Support System Now," CBT Directions, 6: 12-15, (June 1989).

16. Gingerich, Wallace J. "Expert Systems and Their Potential Uses in Social Work," Families in Society: The Journal of Contemporary Human Services, 71: 220-228, (April 1990).
17. Hagglund, Sture. "Emerging Systems for Computer-Based Knowledge Processing in Office Work," Office: Technology and People, 4: 135-145, (May 1989).
18. Hochron, Gary. "Capture That Information on an Expert System," The Journal of Business Strategy, 11: 11-15, (January/February 1990).
19. Holt, Lt Col James R., Director, Civil Engineering and Environmental Graduate Programs. Personal interviews. School of Civil Engineering, Air Force Institute of Technology, Wright-Patterson AFB OH, 1 January through 9 September 1991.
20. Jones, MSgt Robert N., Assistant Supervisor, Plans, Scheduling and Documentation. Telephone interview. 97th SBW/MAMX, Eaker AFB AR, 5 May 1991.
21. Kuntz, TSgt William F. Jr., Supervisor, Plans, Scheduling and Documentation. Personal interviews. 906 CAMS, Wright-Patterson AFB OH, 28 Feb through 15 Aug 1991.
22. Liddle, Capt Jeffrey., An Expert System for the National Electric Code. MS thesis, AFIT/GEM/LSM/89S-12. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1990 (AD-A216131).
23. Lord, Robert G. and Karen J. Maher. "Alternative Information-Processing Models and Their Implications for Theory, Research, and Practice," Academy of Management Review, 15: 9-28, (January 1990).
24. Martin, Capt David P., Logistics Study Project Manager. Telephone interviews. Directorate of Maintenance, Air Force Logistics Management Center, Gunter AFB AL, 30 April through 16 August 1991.
25. Oakley, CMSgt Augustus B., Chief, Aircraft Maintenance Automation. Telephone interviews. HQ SAC/LGMMD, Offutt AFB NE, 5 May through 19 August 1991.
26. O'Keefe, Robert M. et al. "Validating Expert System Performance." IEEE, 2: 81-90, (Winter 1987).
27. Pappas, Fit Lt Paul., Student, Unpublished software, School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 1991.
28. Paton, Robert. "Managing the Expert," Industrial Management and Data Systems, (UK), 4: 20-23, (1989).

29. Pei, Buck K.W. and J. Hal Reneau. "The Effect of Memory Structure on Using Rule-Based Expert Systems for Training: A Framework and an Empirical Test," Decision Sciences, 21: 263-286, (Spring 1990).
30. Peterson, Tim O. "Performance Support Tools: Part of the Quality Work Force Equation," Air Force Journal of Logistics, 14: 18-21, (Winter 1990).
31. Peterson, Lt Col. Tim O., Chief, Supply Directorate, Air Force Logistics Management Center. Personal interview. Gunter AFB AL, 30 April 1991.
32. Schumuller, Joseph and Yingsheng Mi. "Expert System Shells at Work," PC AI, 4: 34-37, (January/February 1990).
33. Shafer, Dan. Designing Intelligent Front Ends for Business Software. New York: John Wiley & Sons, 1989.
34. Thomas, MSgt John J., Branch Chief, Automated Scheduling Branch. Personal interviews. 325 MTS, Tyndall AFB FL, 8 May through 15 August 1991.
35. Thompson, Bev and Bill Thompson. KnowledgePro User Manual. Nassau NY: Knowledge Garden, Inc., 1988.
36. Tucker, Carolyn., Supervisor, Plans, Scheduling and Documentation. Personal interview. 4950th TRW/MAMX, Wright-Patterson AFB OH, 14 Aug 91.
37. Turner, Capt John M. and 1st Lt Earl R. Verble, Jr., Maintenance Scheduling Research. Montgomery AL: Air Force Logistics Management Center, February 1984.

VITA

Captain Kevin A. Gore was born on 16 July 1961 in Sumter, South Carolina. He was graduated from O'Fallon Township High School in May 1979 and then from the United States Air Force Academy in June 1983 with A Bachelor of Science Degree. On active duty since June 1983, he attended Undergraduate Flying Training at Laughlin AFB from August 1983 until August 1984. He also attended Undergraduate Navigation Training from September 1984 until May 1985. He attended and graduated from the Aircraft Maintenance Officer Course in October 1985 and proceeded to Shaw AFB, Sumter South Carolina where he served as AMU OIC; Chief, Programs, Mobility and Analysis Section, and Maintenance Supervisor. He served as Commander, Field Training Detachment 307 from November 1987 and subsequently graduated from Squadron Officers School in October 1988 before ending his commander tour in May 1990. In May 1990, he entered the AFIT School of Systems and Logistics.

Permanent address: 240 Swandale Drive  
Columbia, South Carolina  
29203

# REPORT DOCUMENTATION PAGE

*Form Approved  
OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                 |                                                                |                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------------------|
| 1. AGENCY USE ONLY (Leave blank)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2. REPORT DATE                                                  | 3. REPORT TYPE AND DATES COVERED                               |                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | September 1991                                                  | Master's Thesis                                                |                                                                        |
| 4. TITLE AND SUBTITLE<br><b>AN EXPERT SYSTEM JOB AID FOR USERS OF THE AUTOMATED SCHEDULING MODULE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                 |                                                                | 5. FUNDING NUMBERS                                                     |
| 6. AUTHOR(S)<br><b>Kevin A. Gore, Captain, USAF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                 |                                                                |                                                                        |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br><b>Air Force Institute of Technology, WPAFB OH 45433-6583</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                 |                                                                | 8. PERFORMING ORGANIZATION REPORT NUMBER<br><b>AFIT/GLM/DEV/91S-22</b> |
| 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)<br><b>Air Force Logistics Management Center (AFLMC)/LGM<br/>Gunter AFB AL 36114-6693</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                 |                                                                | 10. SPONSORING / MONITORING AGENCY REPORT NUMBER                       |
| 11. SUPPLEMENTARY NOTES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                 |                                                                |                                                                        |
| 12a. DISTRIBUTION / AVAILABILITY STATEMENT<br><b>Approved for public; distribution unlimited</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                 | 12b. DISTRIBUTION CODE                                         |                                                                        |
| <b>13. ABSTRACT (Maximum 200 words)</b><br><p>The research developed an expert system for novice aircraft schedulers (AFSC: 392XX) with little experience using the Automated Scheduling Module (ASM). First, an in-depth literature review was completed. Next, personal interviews were conducted with an ASM expert and other 392XX personnel. Prototypes using VP-Expert and KnowledgePro shells were created. The KnowledgePro shell was selected to create the ASM Job Aid, combining the knowledge of the expert and AFM 66-279, Vol. XXI. The program was verified, validated, and favorably reviewed by 392XX personnel.</p> <p>Recommendations include: The Air Force Logistics Management Center (AFLMC) examine the job aid and develop a Performance Support System for 392XX personnel. Students attending course MM325-168 should receive a copy of the job aid prior to course start date. Units implementing ASM should receive copies of the job aid in order to add expertise to the program. Finally, TAC should review lessons learned from other commands using ASM. ASM enables schedulers to better forecast when major maintenance expenses will occur. As Defense Management Report Decision (DMRD) 904 becomes a reality in 1992, units with ASM trained schedulers will be better prepared to help manage AF Stock Funds and foster significant savings at the base level.</p> |                                                                 |                                                                |                                                                        |
| 14. SUBJECT TERMS<br><b>Computer Programs, Knowledge based systems, Artificial Intelligence, Expert Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                 |                                                                | 15. NUMBER OF PAGES<br><b>129</b>                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                 |                                                                | 16. PRICE CODE                                                         |
| 17. SECURITY CLASSIFICATION OF REPORT<br><b>Unclassified</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 18. SECURITY CLASSIFICATION OF THIS PAGE<br><b>Unclassified</b> | 19. SECURITY CLASSIFICATION OF ABSTRACT<br><b>Unclassified</b> | 20. LIMITATION OF ABSTRACT<br><b>UL</b>                                |

## AFIT RESEARCH ASSESSMENT

The purpose of this questionnaire is to determine the potential for current and future applications of AFIT thesis research. Please return completed questionnaires to: AFIT/LSC, Wright-Patterson AFB OH 45433-6583.

1. Did this research contribute to a current research project?

- a. Yes                  b. No

2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?

- a. Yes                  b. No

3. The benefits of AFIT research can often be expressed by the equivalent value that your agency received by virtue of AFIT performing the research. Please estimate what this research would have cost in terms of manpower and/or dollars if it had been accomplished under contract or if it had been done in-house.

Man Years \_\_\_\_\_ \$ \_\_\_\_\_

4. Often it is not possible to attach equivalent dollar values to research, although the results of the research may, in fact, be important. Whether or not you were able to establish an equivalent value for this research (3 above), what is your estimate of its significance?

- a. Highly Significant      b. Significant      c. Slightly Significant      d. Of No Significance

5. Comments

Name and Grade \_\_\_\_\_

Organization \_\_\_\_\_

Position or Title \_\_\_\_\_

Address \_\_\_\_\_